RECORD OF DECISION

Bunker Hill Mining and Metallurgical Complex

Shoshone County, Idaho

September 1992

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DECLARATION FOR THE RECORD OF DECISION

SITE NAME

Bunker Hill Mining and Metallurgical Complex Site

LOCATION

The Site is a twenty-one square mile area located in Shoshone County, Idaho. The cities of Kellogg, Smelterville, Wardner and Pinehurst are located within the Site.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the remedial actions selected by the U.S. Environmental Protection Agency (EPA) and the Idaho Department of Health and Welfare (IDHW) for the Non-populated Areas of the Bunker Hill Mining and Metallurgical Complex Site, as well as those aspects of the Populated Areas that were not addressed in the Residential Soils Record of Decision (August, 1991). The remedy was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the Bunker Hill Sitewide Administrative Record file for this Site. The Administrative Record Index is available in the EPA Region 10 Records Center and the Kellogg Public Library.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedial actions described below will eliminate, or reduce to acceptable levels, the exposure pathways at the Site. Together this ROD, and the Residential Soils ROD, prescribe a protective site-wide remedy for the Bunker Hill Mining and Metallurgical Complex Site.

The highlights of the selected remedial actions are presented below by Subarea:

- Hillside Remedial Actions
  - Revegetation of Hillside areas with less than 50% cover
  - Contour terracing of eroded Hillsides
  - Erosion control structures
  - Re-establish riparian habitat

- Smelterville Flats
  - Mitigation of eroding tailings in the SFCDR floodway
  - Consolidation of selected jig tailings into the CIA
  - Establish soil barriers in contaminated areas and revegetate

- Central Impoundment Area (CIA)
  - Consolidation of jig tailings removed during other remedial actions
  - Closure with a low permeability cap
  - Remove material accumulations from 1982 Smelter cleanup and consolidate within the Smelter Closure
  - Relocate slag pile to either CIA or Smelter Complex
  - Collection and treatment of "CIA seeps"

- Page Pond
  - Move tailings from West Page Swamp to Page Pond and cap
  - Cap Page Pond benches with residential soils
  - Maintain access controls (fencing)
  - Channel improvements to Humboldt and Grouse Creeks

- Smelter Complex and Mine Operations Area (MOA)
  - Reprocess, recycle or treat all Principal Threat materials
  - Removal and recycling of salvageable items
  - Demolish structures
  - Decontaminate structures not demolished
  - Cap Lead Smelter and Zinc Plant with low permeability cap
  - Collect and treat Lead Smelter and Zinc Plant closure leachate
  - Place contaminated material under caps (phosphoric acid plan debris, boneyard materials, contaminated soils, etc.)

- Treat acid mine drainage from the Bunker Hill Mine in the Central Treatment Plant prior to discharge to Wetlands treatment system
- Recover and treat ground water in Government Gulch
- Relocate A-1 gypsum pond to CIA
- Cap A-4 gypsum pond, or consolidate within the CIA
- Close solid waste landfills

- Rights-of-Way

  - Implement access controls, and provide for a barrier consistent with land use or removal/replacement

- Commercial Buildings and Lots

  - Barriers, or removals, consistent with land use on all property with lead concentrations over 1000 ppm

- Residential Interiors

  - Continue blood lead monitoring
  - Continue high efficiency vacuum loan program
  - Clean all homes exceeding 1000 ppm lead house dust after remedial actions are completed
  - Home interiors of children identified through health screening will be evaluated, and if needed, site specific remediation implemented
  - Develop and implement interior dust monitoring program

- Future Development in Non-populated Areas

  - Implement remedial actions based upon current land use
  - Through institutional controls, install necessary barrier when land use changes

- Constructed Wetland Treatment Systems

  - Collected Water Wetland in Smelterville Flats for treatment of selected surface water sources, CIA seeps, and Government Gulch groundwater, 74 acres in size
  - Ground water wetland in Pinehurst narrows for treatment of ground water, 34 acres in size .

- Public Water Supply Considerations

  - Abandon and close potentially contaminated wells
  - Provide an alternative source of water for any well used for drinking water

- Operations and Maintenance Requirements
    - Provide for long-term O&M of selected remedial actions

- Institutional Controls
    - Environmental Health Code
    - Performance standards
    - Educational programs
    - Testing and monitoring

- Monitoring
    - Air
    - Surface water
    - Ground water
    - Biological Parameters

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, will comply with federal and state requirements that are legally applicable or relevant and appropriate (unless the contingent waiver discussed in Section 10.2 is invoked), and is cost-effective. The selected remedy utilizes alternative treatment and resource recovery technologies to the maximum extent practicable. Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within the five-years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

Richard P. Donovan — Sept. 21, 1992

Richard P. Donovan
Director
Idaho Department of Health and Welfare

Date

Dana A Rasmussen — 9/22/92

Dana A. Rasmussen
Regional Administrator
U.S. EPA Region 10

Date

RECORD OF DECISION SUMMARY

Site Name: Bunker Hill Mining and Metallurgical Complex Site

Location: Shoshone County, Idaho

1 SITE DESCRIPTION

The Bunker Hill Mining and Metallurgical Complex Superfund Site (Site) is located in Shoshone County, in northern Idaho, at 47°5' north latitude and 116°10' west longitude (Figure 1-1). The Site lies in the Silver Valley of the South Fork of the Coeur d'Alene River (SFCDR). The Silver Valley is a steep mountain valley that trends from east to west approximately 2,250 feet above mean sea level. Interstate Highway 90 crosses through the valley, approximately parallel to the SFCDR.

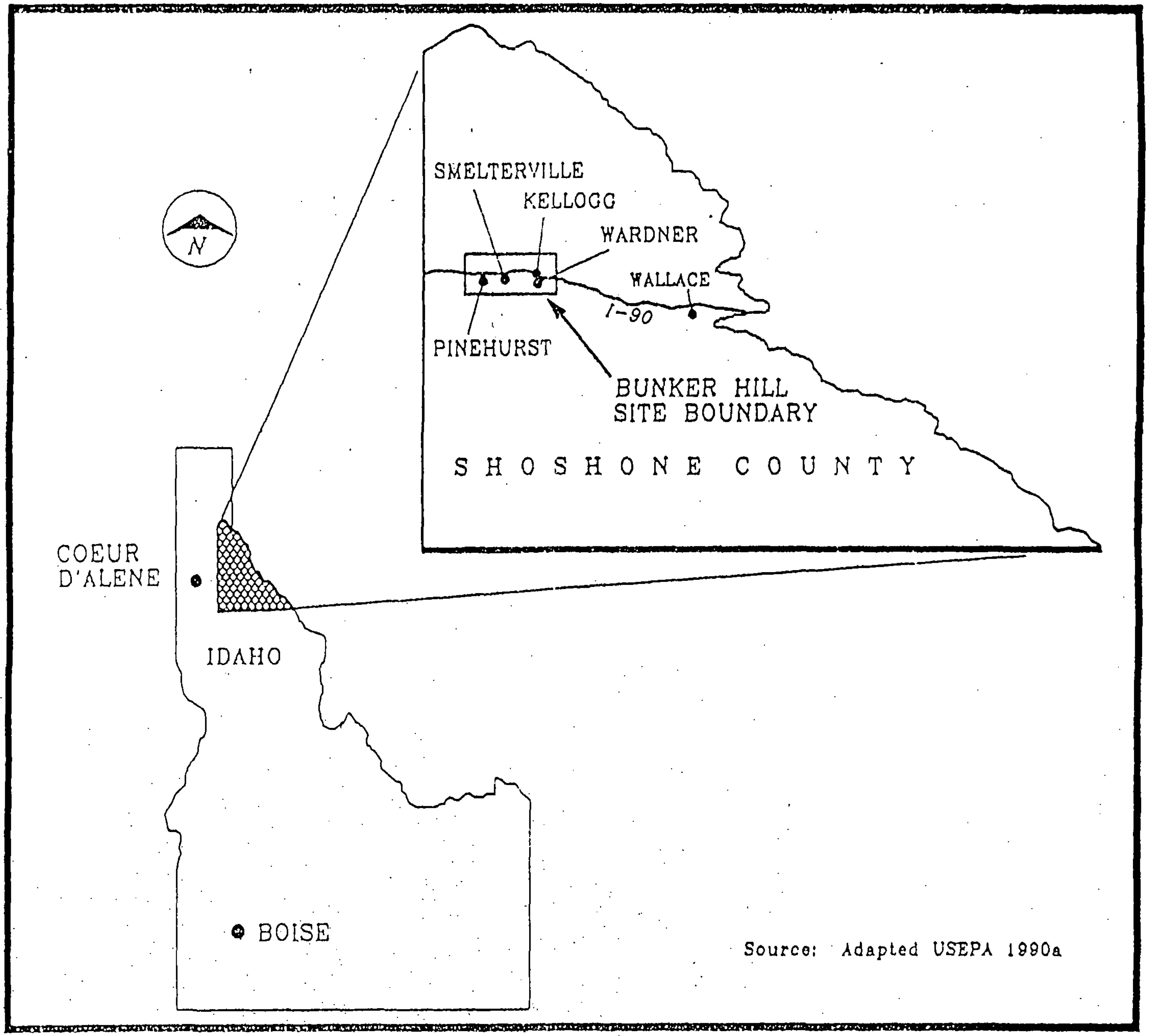
The U.S. Environmental Protection Agency (U.S. EPA) and Idaho Department of Health and Welfare (IDHW) (the agencies), have designated a 21-square-mile study area as the Site for purposes of conducting the Remedial Investigation/Feasibility Study (RI/FS), which has been divided into Populated Areas and Non-populated Areas. This Record of Decision (ROD) addresses contaminated Non-populated Areas of the Site and those aspects of the Populated Areas not covered under the Residential Soil ROD (August 30, 1991). The Site includes the town of Pinehurst on the west and the town of Kellogg on the east (Figure 1-2) and is centered on the Bunker Hill industrial complex. The Site has been impacted by over 100 years of mining and 65 years of smelting activity.

Soils, surface water, ground water, and air throughout the Site have been contaminated by heavy metals, to varying degrees, through a combination of airborne particulate deposition, alluvial deposition of tailings dumped into the river by mining activity, past waste disposal practices, and contaminant migration from onsite sources. Onsite sources include the industrial complex, tailings and other waste piles, material accumulation sites, barren hillsides, and fugitive dust source areas located throughout the Site. Other contaminants include Polychlorinated Biphenyls, PCBs, and Asbestos. The industrial complex consists of:

- The mine, milling, and concentrating operations (This area is designated "A" on Figure 1.3)
- A large tailings impoundment area (B)
- A lead smelter (C)
- A phosphate fertilizer plant (D)

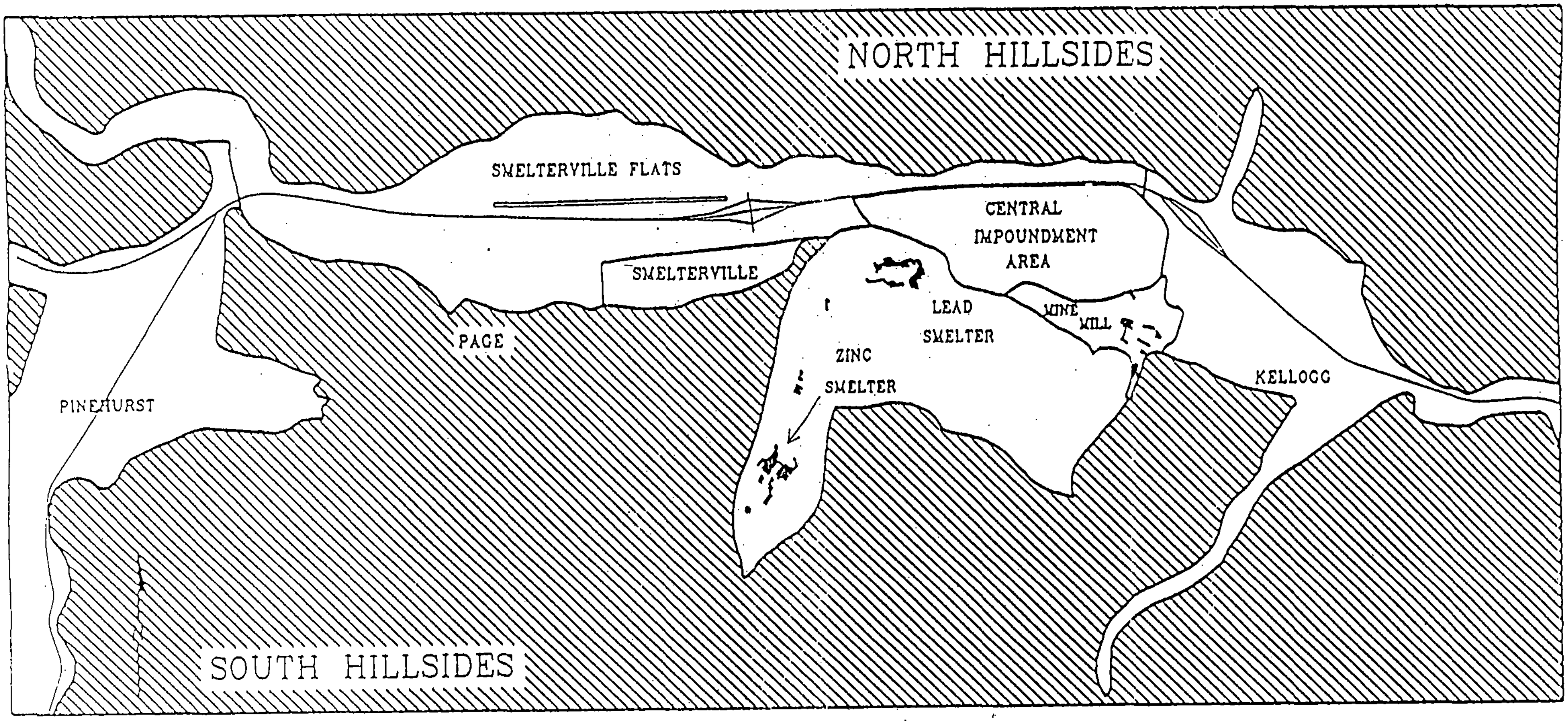
- Three sulfuric acid plants (E)
- An electrolytic zinc plant (F)
- Several large hazardous materials accumulation sites created throughout the Site's history to store both mine and mill tailings, smelter wastes, and by-products

Other onsite sources of contamination will be discussed later in the text.



Source: Adapted USEPA 1990a

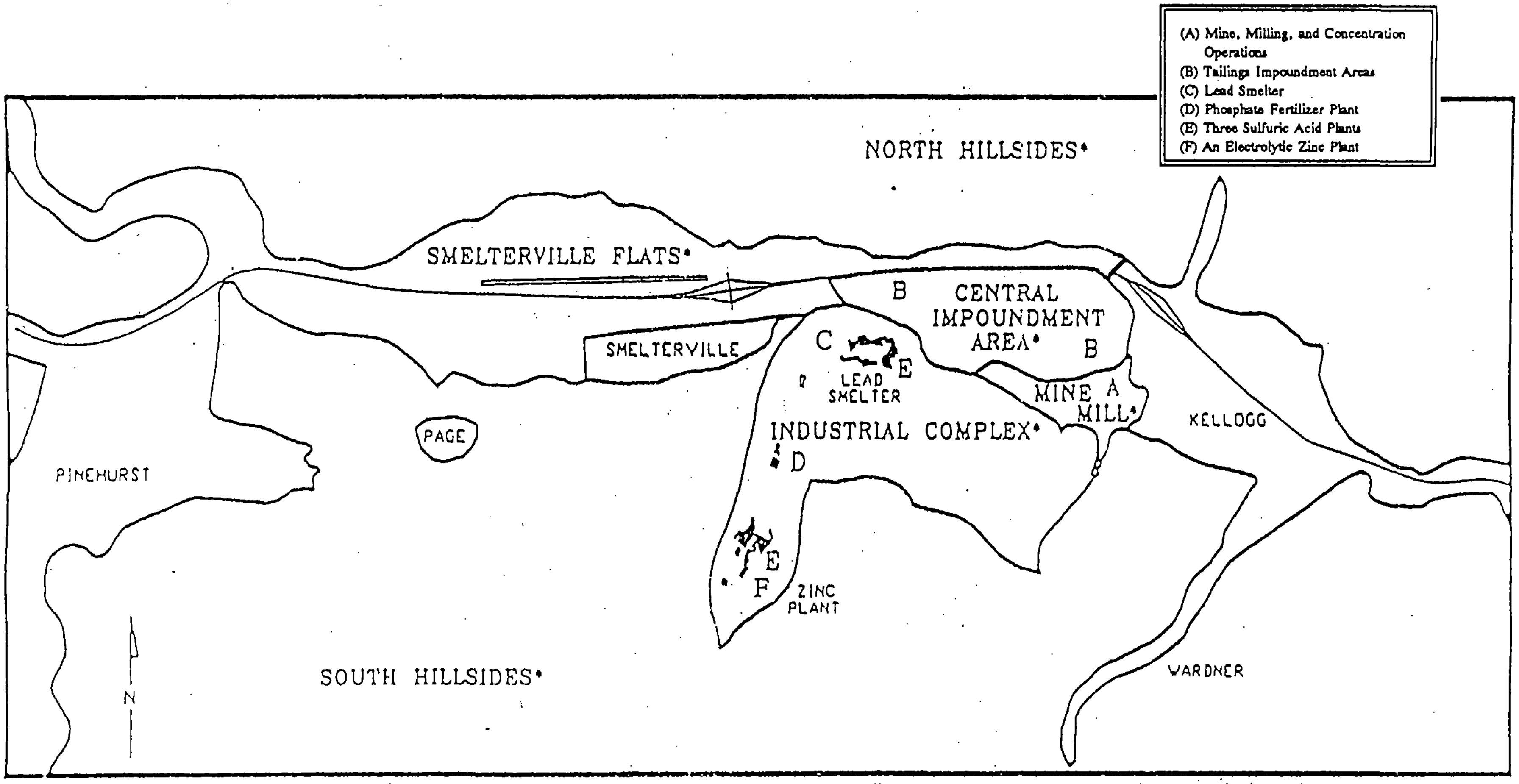
BUNKER HILL SUPERFUND SITE LOCATION IN IDAHO
FIGURE 1.1



Three-mile by seven-mile boundaries

Source: Horizons Inc. Digital Map Data, Aerial Photo Date 7/85

THE BUNKER HILL SUPERFUND SITE
FIGURE 1.2



Approximate Three-mile by Seven-mile Boundaries

Source: Horizons Inc. Digital Map Data, Aerial Photo Data 7/85

BUNKER HILL SUPERFUND SITE GENERAL FEATURES
WITH FIVE MAJOR* NON-POPULATED SUBAREAS,
INDUSTRIAL FACILITIES, AND SUBUNITS
FIGURE 1.3

2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

The Bunker Hill Superfund Site encompasses 21 square miles along Interstate 90 in the Silver Valley area of Northern Idaho (Figure 1-2). The Site encompasses the now inactive Bunker Hill Mining Complex and former metallurgical and smelting facility (the Bunker Hill Complex); the cities of Kellogg, Pinehurst, Smelterville, and Wardner; and the residential areas of Page, Elizabeth Park, and Ross Ranch.

The Bunker Hill Site is part of the Coeur d'Alene Mining District located in northern Idaho and western Montana. Mining for lead, zinc, silver, and other metals began in 1883. The first mill for processing lead and silver ores at the Bunker Hill Complex was constructed in 1886 and had a capacity of 100 tons of raw ore per day. Other mills subsequently were built at the Bunker Hill Complex and the milling capacity ultimately reached 2,500 tons per day.

Before the widespread use of ponds to contain milling waste products, tailings were often disposed of in local surface waters. The South Fork of the Coeur d'Alene River received tailings in this manner from numerous mines and mills in the Silver Valley both in and upstream of the Site. Dams constructed to retain tailings within the floodplain of the SFCDR, as well as subsequent flooding caused the tailings to be spread throughout the valley floor.

The first tailings impoundments in the Silver Valley were located at the Bunker Hill Complex. The Bunker Hill mine tailings impoundment, known as the Central Impoundment Area (CIA) was originally constructed in 1928. The CIA is contained in a ring dike structure built on mine waste rock and other materials. It is presently 60 to 70 feet high, divided into three major cells, including the east cell, the gypsum pond and the slag pile. A small portion of the east cell is presently in use and receives acid mine drainage from the Bunker Hill mine which is subsequently pumped to the Central Treatment Plant (CTP) for pH adjustment and metals removal prior to discharge to Bunker Creek. In 1926, the 70 acre Page Pond tailings impoundment, located within the Site, began operation. It is currently closed, although a wastewater treatment plant, including four unlined lagoons and a 17 acre stabilization pond, was constructed on the impounded tailings and is in operation. Upstream mines were using tailings ponds by the 1960s.

From 1886 until 1917, the lead and silver concentrates produced at the Bunker Hill Complex were shipped to offsite smelters for processing. Construction of the lead smelter began in 1916 and the first blast furnace went online in 1917 producing lead, cadmium, silver, and alloys of these heavy metals. Over the years, the smelter was expanded and modified. At the time of its closure in 1981, the lead smelter had a capacity of over 300 tons of metallic lead per day. Smelting operations resulted in fugitive and stack emission of metals and sulfur dioxide which were deposited throughout the Site.

An electrolytic zinc plant was put into production at the Site in 1928. The zinc plant was owned and operated by the Sullivan Mining Company; until 1955, both the Bunker Hill and Sullivan Mining Company and Hecla Mining Company had a 50% interest in the Sullivan Mining Company. By 1956, the zinc plant was wholly owned by Bunker Hill. Two sulfuric acid plants were added to the zinc facilities in 1954 and 1966, and one sulfuric acid plant was added to the lead complex in 1970. When it was closed in 1981, the zinc plant's capacity was approximately 310 tons per day of cast zinc. A phosphoric acid plant was constructed at the Site in 1960 and a fertilizer plant was built in 1965. The primary products from these plants were phosphoric acid and pellet-type fertilizers composed of varying mixtures of nitrogen and phosphorus. The industrial complex ceased operation in 1981 except for limited mining and milling operations which resumed from 1983 through 1986, and later from 1988 until 1991, as described below.

The Kellogg-based Bunker Hill and Sullivan Mining Company, incorporated in 1887, was the original owner and operator of the Bunker Hill Complex. In 1956, the Bunker Hill and Sullivan Mining Company changed its name to the Bunker Hill Company and in 1968, Gulf Resources & Chemical Company (Gulf) of Houston, Texas, merged with the company. Gulf operated the Bunker Hill mine and smelter facilities until late 1981, when it shut down the entire facility.

As a result of damming the river to impound tailings from flowing downstream, the reworking of jig tailings, historic smelter complex waste discharge and runoff as well as the periodic flooding of the river, waste material laden with lead, zinc, cadmium, arsenic and other heavy metals was deposited onto the valley floor. Surface water, ground water, and soils have all been impacted by metals contamination.

By the early 1970s, emissions from the lead smelter and zinc plant, including sulfur dioxide, total suspended particulates, lead and other heavy metals, contributed significantly to contamination of the surrounding area. Although both the lead smelter stacks utilized a baghouse to capture particulates, stack lead emission rates at the facility averaged from 10 tons per month to about 15 tons per month through the 1960s. After a September, 1973 fire in the baghouse at the lead smelter main stack, air pollution control capacity was severely reduced and there was a dramatic increase in emissions. Total particulate emissions of about 25 to over 140 tons per month, containing 50 to 70 percent lead, were reported from the time of the fire through November 1974. During the first three months of 1974, approximately 73 tons of lead per month were emitted into the environment, with airborne lead levels as high as 30 micrograms per cubic meter on a monthly average being reported. The baghouse was reconstructed in mid-1974.(Interim Site Characterization Report, 1986.)

The immediate health effects of increased total lead emissions following the baghouse fire were observed in 1974 and 1975 U.S. EPA-Silver Valley Lead Health Studies. These comprehensive public health studies documented elevated blood lead levels in a significant number of children. Ninety-eight percent of 179 one to nine year old children living in the highest exposure area near the smelter had blood lead levels above 40 micrograms per deciliter ($\mu g/dl$), while forty percent exceeded 80 $\mu g/dl$. One of the children tested, who had a blood lead level of 164 $\mu g/dl$, subsequently sued the Bunker Hill Company in 1977 for lead poisoning and related injuries. Other children with high blood lead levels also were plaintiffs in that lawsuit as well as a later similar action. Ultimately, the cases were settled. In October 1981, Gulf Resources & Chemical Corporation agreed to pay several of these children approximately $8.8 million through an ongoing trust fund. Yoss et al. v. The Bunker Hill Company et al., Civ. No. 77-2030 (D. Idaho, 1981). Blood lead testing has continued at the Site with the results summarized in numerous U.S. EPA and IDHW reports, as described in Section 2.2 below.

In 1977, a 715 foot tall stack was constructed at the lead smelter and a 610 foot tall stack was installed at the zinc plant in an effort to disperse contaminants from the complex. The stacks decreased sulfur dioxide concentrations in the late 1970s, although building ventilation and fugitive emissions were estimated to be at least as great as the stack emissions. The smelter and other Bunker Hill Company activities ceased operation in late 1981. At that time, portions of the smelter complex were salvaged for various materials, and scrap.

On November 1, 1982, the Bunker Limited Partnership (BLP) purchased the Bunker Hill Complex and related real property from Gulf. At that time Gulf changed the name of the Bunker Hill Company to the Pintlar Corporation, which remains in existence to this date. Bunker Hill Properties, Inc., a Delaware corporation, is the general partner of BLP. There were originally four limited partners of BLP: H.F. Magnuson, Simplot Development Corporation, Hagadone-Idaho, Inc. and Jack W. Kendrick; all of whom also owned varying amounts of stock in Bunker Hill Properties, Inc. Simplot Development Corporation subsequently withdrew from BLP. Since 1984, there have been several transfers of the limited partnership interests in BLP and exchanges of stock in Bunker Hill Properties, Inc. to several newly created corporations of the original limited partners as well as to other related or affiliated entities.

BLP's 1982 acquisition from Gulf included the Bunker Hill mine and related smelter complex facilities, a 50% interest in the Star Unit Area (with Hecla Mining Company controlling the other 50%), the Crescent Silver Mine, approximately 24,500 acres of timberland in Shoshone County and Kootenai County, Idaho and Pend Oreille County, Washington, and approximately 9,500 acres of real property in and around Kellogg, Idaho, including the 350 acre Bunker Hill Complex and mountainous property it leases to the City of Kellogg for the Silver Mt. Ski Area. BLP also took over the former Bunker Hill Company headquarters offices in Kellogg.

BLP reopened the Crescent Silver Mine in late 1983, and operated it until mid-1986. BLP incorporated Crescent Silver Mines, Inc. on July 20, 1984, and Syringa Minerals Corporation (Syringa) on March 21, 1986, as wholly-owned subsidiaries. BLP subsequently transferred certain mining and real property holdings to Syringa, including the Bunker Hill Mine, the smelting and refining facilities, concentrator, and wastewater treatment plant. BLP transferred the Crescent Mine to Crescent Silver Mines, Inc. On August 11, 1987, Syringa incorporated

Minerals Corporation of Idaho (MCI), a Washington corporation, to which it transferred numerous smelter complex holdings, including but not limited to the lead smelter, zinc plant, silver refinery, cadmium plant, phosphoric acid and phosphate fertilizer plant, sulfuric acid plant, and part of the Central Impoundment Area, while distributing MCI stock to BLP. On December 31, 1987, Crescent Silver Mines, and Syringa merged into the Bunker Hill Mining Company (U.S.), Inc., a wholly-owned subsidiary of the Bunker Hill Mining Company, a Canadian corporation incorporated in British Columbia on June 25, 1987.

The Bunker Hill Mining Company (U.S.), Inc. (BHMC) reopened the Bunker Hill mine in September 1988, with financing obtained through the sale of $7.2 million of public shares of stock sold on the Vancouver Stock Exchange in May 1988. As the price of zinc rose in 1989, BHMC sold additional shares of stock and raised more capital for a planned expansion of the mine. Following a 1990 drop in prices for zinc, silver, and lead, BHMC could no longer meet financial obligations. On January 17, 1991, BHMC filed for relief under Chapter 11 of the U.S. Bankruptcy Code and ceased operations.

BLP filed for Chapter 11 Bankruptcy protection on June 28, 1991. Although BLP continued to control over $20 million in timberlands (in part encumbered by a mortgage of approximately $10 million) and other assets at the Bunker Hill Complex and throughout northern Idaho, it filed for bankruptcy as a result of litigation commenced in 1987 by Gulf Resources & Chemical Corporation over liability for the medical and pension benefits of the former Bunker Hill workers. Pintlar Corporation and Gulf Resources & Chemical Corporation v. Bunker Limited Partnership et al., No. 90976 (Fourth Judicial District of Idaho). On June 13, 1992, Gulf succeeded in obtaining prejudgment attachment liens on 24,500 acres of BLP's timberlands based on its $60 million claim against BLP for workers' pension and medical payments which Gulf alleged BLP was liable for as a result of its breach of the 1982 purchase contract with Gulf. BLP filed for bankruptcy protection shortly thereafter.

BLP and BHMC are presently in the process of liquidating their assets and selling all of their remaining property pursuant to now final Bankruptcy Plans. As described in Section 2.5.3 below, a substantial portion of both BHMC's and BLP's assets are being used for cleanup of the Bunker Hill Complex pursuant to Administrative Orders issued by U.S. EPA.

The Bunker Hill Complex is still largely owned, operated, and controlled by BLP as the debtor in possession along with its general partner BH Properties, Inc. and wholly-owned subsidiary, Minerals Corporation of Idaho, and by BHMC as the debtor in possession of the Bunker Hill mine operating area. BHMC has sold several properties at the mine operations area to various entities and individuals, including the Bunker Hill mine portal. BLP has sold certain other property at the Bunker Hill Complex and in and around Kellogg to various entities and individuals. In addition, certain property of Minerals Corporation was acquired by the Pintlar Corporation pursuant to BLP's confirmed Chapter 11 Bankruptcy Reorganization Plan. BLP has also executed several options with Pintlar Corporation to sell property owned by it and its subsidiary Minerals Corporation of Idaho, including property surrounding the lead smelter and zinc plant. There are currently no known active mining or other mineral production activities at the Bunker Hill Complex.

Over the past 10 years, BLP, BHMC and their subsidiaries and predecessors have shipped a variety of wastes offsite for salvage, recycling, and disposal. Thousands of tons of sludge, tailings, flue dust, and other wastes remain at the complex.

Contamination at the Site was characterized during Remedial Investigation/Feasibility Studies (RI/FS) conducted from 1987 to 1992. Risks to human health were evaluated through the Risk Assessment Data Evaluation Report (RADER), October 1990, and the Human Health Risk Assessment (HHRA), May 1992. Risks to the environment were evaluated in the Ecological Risk Assessment (ERA), November 1991.

2.2 INITIAL INVESTIGATIONS

Contaminated air, soils, and dusts have been identified as contributors to elevated blood lead levels in children living in the Populated Areas of Site. Environmental media concentrations of Site contaminants of concern in the Populated Areas are strongly dependent on distance from the smelter facility and industrial complex. Residential areas nearest the smelter complex have shown the greatest air, soil, and dust lead concentrations; the highest childhood blood lead levels; and the greatest incidence of excess absorption in each of the studies conducted in the last decade.

Health effects of environmental contamination were first documented following the smelter baghouse fire in 1973 and associated smelter emissions in 1973 and 1974. In an August 1974 survey, 98 percent of the 1- to 9-year-old children living within 1 mile of the smelter were found to have blood lead levels in excess of 40 μg/dl. The frequency of abnormal lead absorption (defined at the time as greater than or equal to 40 μg/dl) was found to decrease with increasing distance from the smelter. Several local children were diagnosed with clinical lead poisoning and required hospitalization. Lead health surveys conducted throughout the rest of the 1970s confirmed that excess blood lead absorption was endemic to this community. Concurrent epidemiologic and environmental investigations concluded that atmospheric emissions of particulate lead from the active smelter were the primary sources of environmental lead that affected children's blood lead levels prior to 1981. Contaminated soils were also found to be a significant, secondary source of lead to children in the 1970s.

Following lead poisoning incidents in 1973-74, a number of activities were instituted to decrease lead exposures and uptakes in the community. Emergency measures were initiated to reduce the risk of lead intoxication. These measures included: chelation of children with blood lead over 80 μg/dl, purchase and destruction of as many homes as possible within 0.5 mile of the smelter, distribution of "clean" soil and gravel to cover highly contaminated areas, initiation of a hygiene program in the schools, and reduction of ambient air lead levels through reduction of smelter emissions. Street cleaning and watering in dust-producing areas occurred during several periods in the late 1970s. Subsidies were provided by the Bunker Hill Company to residents for the purchase of clean top soil, sand, gravel, grass seed, and water; thereby promoting some yard cover in the community.

An analysis of historical exposures to children who were two years old in 1973 suggests a high risk to normal childhood development and metal accumulation in bones because of extreme exposures; these exposures could pose a continuing lead body burden in these children because of its long physiologic half life. Females who were two years of age during 1973 are now of childbearing age and, even with maximum reduction in current exposure to lead, the fetus may be at risk because of resorption of bone lead stores in the young women. ATSDR is currently evaluating the feasibility of reconstructing this cohort of individuals to determine their past health experience. If accomplished this might lead to improved health care through education of both patient and physician.

Following smelter closure in late 1981, airborne lead contamination decreased by a factor of about 10, from approximately 5 $\mu g/m^3$ to 0.5 $\mu g/m^3$. A 1983 survey of children's blood lead levels demonstrated a significant decrease in community exposures to lead contamination; however, the survey also found that several children, including some born since 1981, continued to exhibit blood lead levels in excess of recommended public health criteria. Accompanying epidemiological analyses suggested that contaminated soils and dusts represented the most accessible sources of environmental lead in the community.

Childhood mean blood lead levels have continued to decrease since 1983. These decreases are likely related to a nation wide reduction in dietary lead; reduced soil, dust, and air levels in the community; intake reductions achieved through denying access to sources; and the increase in family and personal hygiene practiced in the community. The latter is reflected in the implementation of a comprehensive Community Health Intervention Program in 1984 that encourages improved hygienic (housekeeping) practices, parental awareness, and special consultation on individual source control practices such as lawn care. The Community Health Intervention Program was initiated specifically to reduce the potential for excess absorptions and minimize total absorption in the population. Total blood lead absorption among the community's children has been reduced nearly 50 percent since 1983. The incidence of lead toxicity (blood lead > 25 $\mu g/dl$) has fallen from 25 percent to less than 5 percent for children in the highest exposure areas. Recent blood lead monitoring has shown approximately 20 percent of area children surveyed exceed the blood lead level of 10 $\mu g/dl$.

2.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

The Site was placed on the National Priorities List (NPL) in September 1983 (48 FR 40658). RI/FS activities were initiated in late 1984 following completion of the 1983 Lead Health Study.

The Bunker Hill Site Characterization Report (SCR) was the first step in the RI process. The objective of the SCR was to describe and analyze existing information. The existing information included files from federal, state, and local agencies, as well as information obtained from past and present owners and operators of the industrial complex. The SCR was then used to identify data gaps and develop work plans for the remedial investigation.

In recognition of the history and complexity of this Site, and the continuing need for active health intervention efforts, the U.S. EPA and IDHW developed an integrated project structure for RI/FS activities. The Site was divided into two study areas, the Populated Areas and the Non-populated Areas. The Populated Areas include four cities, residential and commercial properties located within those cities, and other residential properties. The Non-populated Areas include the smelter complex, river floodplain, barren hillsides, ground water, surface water, air, and industrial waste components of the Site.

While separate RI/FS efforts were initiated for each portion of the Site, U.S. EPA retained oversight and risk assessment responsibilities for both portions. IDHW performed the Populated Areas RI/FS. The Non-populated Areas RI/FS was performed by Gulf Resources & Chemical Corporation (Gulf U.S.A. Corporation/Pintlar) under a May 1987 U.S. EPA Administrative Order on Consent (1085-09-09-104). Subsequently, additional PRPs, including: Asarco Incorporated, Callahan Mining Company, Coeur d'Alene Mines Corporation, Hecla Mining Company, Stauffer Management Company, Sunshine Mining Company, Sunshine Precious Metals Company, and Union Pacific Railroad participated in developing deliverables for the FS. Table 2-1 lists the major geographic features and investigation emphases.

In order to thoroughly investigate the contamination of Site wide soils, surface water, ground water, and air, the Non-populated RI/FS Work Plan subdivided the Site into five major areas: Hillside Areas, Smelterville Flats, Page Pond, Central Impoundment Area (CIA), and the Smelter Complex. Based upon a proposal by the PRPs to develop a comprehensive FS, portions of the Populated Areas not covered in the Residential Soil Feasibility Study (RI/FS) prepared by CH2M Hill for the IDHW were addressed in the Non-populated RI/FS. These modifications included: the addition of areas not previously defined as separate areas, including rights-of-way (ROW) within the Populated areas of the Site; currently undeveloped areas which are likely to be developed; commercial buildings and lots; and, residential house interiors. An additional modification was the separation of the Smelter Complex into two areas delineated in the RI/FS Work Plan as the Smelter Complex and the Mine Operations Area (MOA). The identified subareas within the Non-populated areas of the Site include:

1. Hillside Area;
2. Smelterville Flats;
3. Central Impoundment Area;
4. Page Pond;
5. Smelter Complex;
6. Mine Operations Area;
7. ROW within the Non-populated Areas; and,
8. Future Development.

Table 2-1 Major Features and Investigation Emphasis	
Major Geographic Features	Investigation Emphasis
Populated Areas	
• Pinehurst	• Contaminated Soils and Dust
• Page	• Residential Properties
• Smelterville	• Commercial Properties
• Kellogg	• Roadways/Railways
• Wardner	• Fugitive Dust Sources
• Ross Ranch	• House Dust
• Elizabeth Park	• Airborne Contamination
Non-populated Areas	
• Hillsides	• Soil and Surface Materials
• Bunker Hill Smelter Complex Area	• Surface Water
• Central Impoundment Area (CIA)	• Ground Water
• Smelterville Flats	• Air/Atmospheric Transport
• Mine Operation Area	• Vegetation
• River Channel Area	• Buildings/Process Equipment
• East Page Swamp	• Material Accumulation Site
• West Page Swamp	• Contamination at Depth
• Page Pond	• Contaminant Migration

The three populated areas of the Site added to the Non-populated RI/FS include:

9. Commercial Buildings and Lots;
10. ROW within the Populated Areas; and,
11. Residential house interiors.

2.4 HISTORY OF CERCLA ENFORCEMENT INVESTIGATIONS

Since the beginning of mining in 1885 and smelting operations in 1917, large quantities of a variety of waste products, including process tailings, flue dust, slag, and airborne emissions have been released into the environment at the Site. These wastes contain lead, cadmium, zinc, copper, arsenic, antimony, mercury, silver, and other metal elements. Large quantities of these waste products remain in the environment in and around the Bunker Hill Superfund Site, including in the residential soils within the populated areas of the Site.

U.S. EPA began its CERCLA enforcement investigations at the Site in 1983. Since that time, U.S. EPA has conducted numerous investigations regarding those persons or parties which may be responsible for the payment or response costs pursuant to Section 107(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9607(a). Several companies have been identified by U.S. EPA as potentially responsible parties (PRPs) for the Site. The U.S. EPA is continuing to investigate additional parties which may be liable for the cleanup costs at the Site. Table 2-2 lists the current PRPs for the Site and the dates they were notified.

The PRPs represent a combination of past and present property owners, owners and operators of the various smelting, processing, and production facilities located within the industrial complex, and upstream mining companies responsible for discharges of mine and mill tailings into the South Fork of the Coeur d'Alene River that have contributed to the contamination of the Site.

The current upstream mining company PRPs include Asarco, Inc., Hecla Mining Company (also named as a PRP on the basis of 50% interest in the Sullivan Mining Company, which owned and operated the zinc plant), Coeur d'Alene Mines Corporation and Callahan Mining Company (which merged in 1991), Sunshine Mining Company and its wholly-owned subsidiary Sunshine Precious Metals, Inc. (currently in Chapter 11 Bankruptcy reorganization), Silver Bowl, Inc., and Highland Surprise Consolidated-Mining Company.

U.S. EPA is also continuing to investigate a number of other mining companies which previously conducted mining activities upstream of, or within, the Bunker Hill Site. In addition to investigating the potential liability of these companies, U.S. EPA is investigating the potential liability of other owners, operators and generators at the Site.

U.S. EPA has determined that selection or initiation of remedial action for the Site should not be delayed pending an investigation of additional PRPs.

Table 2-2 Potentially Responsible Parties Identified for the Bunker Hill Superfund Site	
Name of Company	Notification Date
Gulf Resources and Chemical Corporation	10-18-84
Bunker Limited Partnership	10-18-88 and 10-04-89
Minerals Corporation of Idaho	10-04-89
Bunker Hill Mining Company (U.S.), Inc.	10-04-89
BH Properties, Inc.	10-04-89
Syringa Minerals Corporation	10-04-89
Hecla Mining Company	10-04-89
Stauffer Chemical Company	10-04-89
ASARCO, Inc.	02-07-90
Callahan Mining Corporation	02-07-90
Highland Surprise Consolidated-Mining Company	02-07-90
Silver Bowl, Inc.	02-07-90
Sunshine Precious Metals, Inc.	02-07-90
Union Pacific Railroad	02-07-90
Coeur d'Alene Mines Corporation	02-07-90
Sunshine Mining Company	06-07-91

2.5 REMOVAL AND RESPONSE ACTIONS

The presence of elevated levels of metals, such as lead, zinc, cadmium, and arsenic in the soil, ground water, and surface water, is a result of the historic mining, milling, and smelting activities in the valley. In order to minimize or eliminate contaminant exposures and uptakes, U.S. EPA has developed and implemented several removal and emergency response actions for the community within the Site.

Pursuant to U.S. EPA's removal action authority under Sections 104 and 106(a) of CERCLA, 42 U.S.C. §§ 9604 and 9606(a), U.S. EPA has performed, required, and overseen the performance of five residential area removal actions, including removal of contaminated soils from residential yards and dust control in the residential areas of the Site. U.S. EPA also issued two Administrative Orders, pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a), in 1989 and 1991, to several of the Bunker Hill PRPs for performance of removal activities at the Bunker Hill Complex.

2.5.1 Residential Area Removal Actions

U.S. EPA performed two removal actions at the Site, in 1986 and 1989. In 1990, 1991, and 1992, the PRPs jointly funded additional residential area removal actions, with U.S. EPA and IDHW performing oversight activities.

In 1986, 16 public properties (parks, playgrounds, and road shoulders) were selected for an immediate removal action because these properties contained high concentrations of lead and were frequented by many area children. This action, conducted by U.S. EPA, consisted of placing a barrier between children and the underlying contaminated soil. Six inches of contaminated materials were excavated, and clean soil, sod and/or gravel were imported for replacement. Excavated material was temporarily stored within Site boundaries at property owned by the Idaho Transportation Department (ITD).

In 1989, U.S. EPA and IDHW conducted the first residential soil removal action at the Site, beginning a program of four consecutive years of residential soil removal actions performed during the summer months each year. The program prioritized yards that had a lead concentration greater than or equal to 1,000 ppm and housed either a young child or a pregnant woman. This action consisted of removing 6 to 12 inches of contaminated material from yards and replacing it with clean material. Contaminated soils were again stored at the ITD property within Site boundaries. In 1989, yard soil replacement was completed at 81 homes and 2 apartment complexes within the Populated Areas of the Site.

In 1990, U.S. EPA began discussions with a number of the PRPs for continuation of the residential soil removal program and related response actions. U.S. EPA requested that the PRPs jointly fund and perform the removal action under U.S. EPA and IDHW oversight. Though negotiations continued for several months, no agreement was reached. On May 15, 1990, U.S. EPA issued the PRPs an Administrative Order (U.S. EPA Docket No. 1090-05-25-106), which ordered the PRPs to perform this work. U.S. EPA subsequently negotiated an Administrative Order on Consent (U.S. EPA Docket Number 1090-05-35-106) with eight of the PRPs (Gulf Resources & Chemical Corporation, Hecla Mining Company, ASARCO, Inc., Stauffer Chemical Company, Callahan Mining Corporation, Coeur d'Alene Mines Corporation, Sunshine Precious Metals, Inc., and Union Pacific Railroad) for payment of approximately three million dollars to U.S EPA for performance of the 1990 residential soil removal action. Yard soil removal and replacement for an additional 130 yards were performed in 1990. Excavated soils from this removal action were stored at the Page Ponds tailings impoundment.

In July of 1991, an Administrative Order on Consent (U.S. EPA Docket No. 1091-06-17-106(a)) was entered into between U.S. EPA and nine PRPs (Gulf Resources & Chemical

Corporation, Hecla Mining Company, ASARCO, Inc., Stauffer Chemical Company, Callahan Mining Corporation, Coeur d'Alene Mines Corporation, Sunshine Precious Metals, Inc., Sunshine Mining Company, and Union Pacific Railroad) that required the PRPs to perform the residential soil removal program. Approximately 100 yards were cleaned up under the Order during the summer and fall of 1991, and the PRPs also agreed to undertake Site wide dust control actions; monitor air, ground water and surface water; enhance the fire fighting capability at the industrial complex; and provide funding to purchase high-efficiency vacuums for loan as part of the Health Intervention Program. As in 1990, excavated soils were stored at the Page Ponds tailings impoundment.

On July 29, 1992, U.S. EPA entered into a Administrative Order on Consent (U.S. EPA Docket No. 1092-04-14-106) with the same nine PRPs, requiring these PRPs to perform the fourth consecutive residential soil removal action at the Site. This Order also requires the PRPs to remove and relocate contaminated soil temporarily stored on ITD property from previous removal actions to the Page Pond Tailings impoundment, undertake dust control activities, perform monitoring activities, provide up to $20,000.00 to fund the Panhandle Health District's lead intervention program, conduct repair work at properties cleaned up under the July 1991 AOC, and provide disposal and transportation services (and replacement soil) for contaminated soil excavated from residential and commercial properties within the Site.

2.5.2 Non-populated Area Response Actions

On October 24, 1989, U.S. EPA issued an Administrative Unilateral Order (U.S. EPA Docket Number 1089-10-21-106) pursuant to CERCLA § 106(a) against Bunker Limited Partnership, Minerals Corporation of Idaho, Bunker Hill Mining Co. (U.S.), Inc., and Gulf Resources & Chemical Corporation. U.S. EPA ordered these parties to immediately respond to releases and threats of releases of hazardous substances at the Bunker Hill Complex which the U.S. EPA determined were required to protect the public health or welfare or the environment, and to address risks to the public health or welfare or environment which the Agency for Toxic Substances and Disease Registry had identified from its investigation of the Site. Actions required by the Order included immediate cessation of salvaging activities onsite, establishment of site access restrictions, development of a dust control plan, and stabilization and containment of the copper dross flue dust pile and other hazardous substances at the Bunker Hill Complex.

On October 1, 1990, U.S. EPA entered into an Administrative Order on Consent with Gulf Resources & Chemical Corporation, and Hecla Mining Company (U.S. EPA Docket No. 1090-10-01-106) for the performance of hillside stabilization and revegetation work. The Order requires erosion control by reestablishing a native, coniferous forest and understory vegetative cover to approximately 3,200 acres of barren hillsides and to perform terrace repair and construction of detention basins, and repair of the eroding hillside areas in Wardner and Smelterville.

To control contaminated sediment transport from the hillside areas, and to facilitate establishing vegetation, over forty miles of terraces have been constructed to date. A total of one half million trees have been planted on barren hillside slopes during 1991 and 1992. Approximately 350,000 trees are scheduled to be planted in 1993.

17,000 square yards of geotextile blankets have been installed along the Smelterville Slopes and 6,000 square yards along the Wardner slopes. The blankets help stabilize the soil and slows erosion. A number of large detention basins have been constructed in Deadwood Gulch, Magnet Gulch, Government Gulch, and the Page Mine area to control erosion and sediment loadings from those areas to SFCDR.

Several abandoned mine dumps in the hillside area have been regraded and planted with adapted vegetation. In June, 1992, work to recontour and revegetate the Silver Bowl area was completed. Approximately 40 acres of barren hillside were revegetated with grass, trees and shrubs. Approximately 60% of the Page Mine Area was revegetated with grass and approximately 10,000 trees were planted. The remainder of the Page Mine area will be revegetated during the 1993 planting season.

To protect certain residential properties from erosion a 2,600 foot rock-lined diversion channel and 600 feet of sediment retention structures have been constructed in the Smelterville area. Cribbing walls and other sediment retention structures have also been installed in Wardner and Kellogg.

On September 27, 1991, U.S. EPA issued an Administrative Unilateral Order to the Bunker Limited Partnership, Minerals Corporation of Idaho, and Bunker Hill Mining Co. (U.S.), Inc. (U.S. EPA Docket No. 1092-09-15-106) which directed immediate actions to cleanup and prevent releases of hazardous substances at the Bunker Hill Complex, including the copper dross flue dust pile, mercury sludge and acid tanks, PCB-contaminated electrical transformers, acid mine drainage, lead tailings and dust, and other waters continuing to be released at the complex. The Order also prohibits salvage activities, responsible for a serious fire on September 23, 1991, which destroyed the mine rock house and concentrator conveyor system and damaged other mine buildings.

Work under this Order has proceeded with funding coming primarily from the bankruptcy estates of the Bunker Limited Partnership (BLP) and Bunker Hill Mining (BHM)(U.S.). In addition, certain portions of the work at the Bunker Hill Complex are being funded or performed by Pintlar and Gulf. To date, approximately 935,500 pounds of mercury acid sludge were removed from a large storage tank while about 360 drums containing such materials were also removed and taken to a hazardous waste landfill in Arlington, Oregon.

Approximately 130 transformer carcasses that had been stored in the phosphate plant were recently taken to an approved facility for disposal. Transformers and electrical equipment containing PCB oil were removed from the Bunker Hill mine in the spring of 1991, prior to shut down and flooding of the mine. The transformers were drained and properly disposed of.

In addition, 40 drums of PCB oil stored in the company warehouse were removed and incinerated at an offsite facility.

Work to relocate 25,000 cubic yards of Copper Dross Flue Dust (CDFD) from Magnet Gulch to an area in the Smelter Complex protected from runoff commenced in April 1992, and was completed in June, 1992. The machine shop at the lead smelter was demolished and the CDFD was moved to the machine shop's concrete pad. The CDFD contains about 40% lead, 11% arsenic and 9% zinc, and will undergo further treatment and stabilization before final disposal. Treatability studies are being performed on the CDFD in order to determine an appropriate cement based stabilization mixture for treatment.

Following removal of the CDFD from Magnet Gulch, temporary pipes were installed on the east side of Magnet Gulch to carry runoff from the A-1 Gypsum Pond to a diversion ditch and into Deadwood Gulch.

Actions taken to control contaminated windblown dust include thirty-six acres stabilized with rock surface armoring and 142 acres stabilized by chemical polymer sealing, including portions of the CIA. Other areas have received approximately 6 inches of organic amendments to promote revegetation efforts.

2.5.3 U.S. EPA CERCLA Cost-Recovery and Enforcement Litigation

As discussed above, U.S. EPA has undertaken a variety of investigatory, response, and enforcement actions regarding the release of hazardous substances at the Bunker Hill Superfund Site. Although certain response actions have been funded by the PRPs, U.S. EPA has incurred approximately $21 million in response costs through August 1992. U.S. EPA has recovered over $6.27 million from the PRPs as follows: $1.44 million from a 1989 Partial Consent Decree with Gulf and from Gulf's repayment of over $1.65 million of U.S. EPA's RI/FS oversight costs. In addition, U.S. EPA received $3.18 million as a cashout payment from eight PRPs pursuant to the 1990 Administrative Order on Consent discussed previously.

In 1989, U.S. EPA recovered $1.44 million (included in the totals above) from Gulf for the Agency's performance of the 1986 Fast Track removal action to remove and replace lead contaminated soil from public playgrounds, road shoulders and other public areas accessible to young children. These funds were recovered through a Partial Consent Decree entered on December 5, 1989, in a cost recovery action filed in the United States District Court for the District of Idaho. United States v. Gulf Resources & Chemical Corporation et al., Civil No. 89-3067 (D. Idaho).

U.S. EPA also receives yearly oversight payments from Gulf under the 1987 Administrative Order on Consent issued by U.S. EPA for performance of the remedial investigation and feasibility study (RI/FS) for the Non-populated Areas of the Site. Through February 1992, these payments have amounted to $1.65 million (included in the totals above). The Non-populated Areas RI/FS was completed in May 1992, and U.S. EPA issued the Proposed Plan for remedial action of the Non-populated Areas on June 12, 1992. The Populated Area RI and the Residential Soils FS were completed in 1991. U.S. EPA issued a ROD in August 1991 which set forth the selected remedial action for cleanup of residential yard soils, at an estimated cost of $40 million.

On July 2, 1990, the U.S. District Court in Idaho granted U.S. EPA's December 1988 petition to unseal the court files in Yoss v. Bunker Hill Company et al., Civ. No. 77-2030 (D. Idaho). See In the Matter of a Petition by the United States of America to Unseal The File in Yoss v. Bunker Hill Company et al., Civ. No. 77-2030 (D. Idaho, Case No. MS-3505, July 2, 1990). U.S. EPA subsequently copied and reviewed the files in this 1977 child lead poisoning case, which contain a variety of documents and materials pertaining to the September 1973 bag house fire at the Bunker Hill lead smelter. U.S. EPA also subsequently obtained the parties' trial exhibits from this case, discovery materials and other relevant documents, which U.S. EPA has used in developing a variety of reports and documents pertaining to the Site.

From January to March, 1991, U.S. EPA filed liens on properties owned by BLP and MCI within the Site, to help secure U.S. EPA's claims against these companies for past cleanup costs. The liens were filed pursuant to Section 107(1) of CERCLA, 42 U.S.C. § 9607(1).

On July 13, 1992, the U.S. Bankruptcy Court in Spokane entered an Order confirming the Bunker Limited Partnership's (BLP) Chapter 11 Reorganization Plan. In Re Bunker Limited Partnership, No. 91-02087K11 (Spokane, Wa). The final Plan required BLP to deposit additional funds (approximately $5 million) into its "EPA Remediation Account" to bring the total in the account to $7 million. In January 1992, the Bankruptcy Court ordered BLP to deposit $2 million into this account. These funds will be used by BLP to perform cleanup activities pursuant to the September 27, 1991, Administrative Order issued by U.S. EPA. After payments to certain other creditors, BLP is required to deposit an additional $6 million into the account as part of U.S. EPA's post-confirmation claim.

The Chapter 11 Reorganization Plan also requires BLP to liquidate its remaining assets, including 3,700 acres of timberland not yet sold, 9,500 acres of land in and around Kellogg, Idaho, 6,000 acres of which are within the Site, and upon which U.S. EPA previously filed liens. From the proceeds of these future sales, BLP is required to deposit $6 million into the U.S. EPA Remediation Account (in addition to the $7 million) to be used to perform response actions at the Site. To the extent the liquidation of BLP's estate generates additional funds, there will be a pro rata distribution to the unsecured creditors, of which U.S. EPA is the largest creditor ($100 million Allowed Unsecured Claim).

U.S. EPA is currently overseeing BLP's cleanup activities pursuant to the September 27, 1991, Administrative Order. Several million dollars have been spent since January 1992 from BLP's U.S. EPA Remediation Account. As described in Section 2.5.2 above, these funds have been used for relocation of a large copper dross flue dust pile in Magnet Gulch, removal of mercury sludge barrels, treatment of acid mine drainage, disposal of acid wastes and contaminated equipment at the Bunker Hill complex, and dust suppression work.

U.S. EPA also issued the September 1991 Section 106 Order to the Bunker Hill Mining Company (U.S.), Inc. (BHMC), owner and operator of the Bunker Hill and Crescent Mines. After BHMC declared bankruptcy, U.S. EPA negotiated the removal of PCB transformers from the mine before it flooded when power to the dewatering pumps was turned off. BHMC's Liquidation Plan was confirmed by the Idaho Federal District Bankruptcy Court in August 1991. Bunker Hill Mining Company (U.S.), Inc., (Chapter 11 Bankruptcy, Civ. No. 91-00161, Coeur d'Alene, Idaho).

BHMC's Liquidation Plan provides that, after payment of taxes, all proceeds will go as an administrative expense toward response actions performed by U.S. EPA for the Site. Although there are few valuable assets in BHMC's bankruptcy estate, U.S. EPA is continuing to receive a portion of the proceeds from the sale of BHMC's property. BHMC has thus far generated over $100,000 from the sale of assets that will be used to fund U.S. EPA cleanup activities at the mine complex. Additional funds will be generated as BHMC continues to sell its assets. As a result of several recent sales, including the sale of the mine portal, rock house, and ore concentrator, BHMC is funding the disposal of PCB oil and equipment and dust control activities.

Sunshine Precious Metals, Inc. (SPMI), also filed for bankruptcy protection on March 20, 1992. SPMI, one of the PRPs for the Site, is currently in Chapter 11 Bankruptcy and is seeking confirmation of its Reorganization Plan. This Plan, as currently drafted for court approval, provides that U.S. EPA's claim will not be discharged. Although SPMI disputes U.S. EPA's claim, it has agreed that U.S. EPA's claim will not be impaired and will survive confirmation with whatever rights existed prior to March 20, 1992. This will enable U.S. EPA to reach a settlement with SPMI regarding its liability for the Site, or if necessary, litigate such claims in court.

U.S. EPA will continue to oversee BLP's and BHMC's cleanup activities with funds obtained pursuant to the two final Bankruptcy Plans. U.S. EPA is continuing to closely monitor the various bankruptcy proceedings and prepare for other necessary enforcement actions at the Site, including consent decree settlement negotiations with the PRPs for the performance of remedial actions and reimbursement of past and future costs incurred by U.S. EPA.

3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The specific requirements for public participation at the Site include releasing the RI/FS and Proposed Plan to the public. This was done on June 15, 1992. Both documents were placed in the Administrative Record and information repositories. Notices of the availability of these documents, a public meeting on the Proposed Plan and a public comment period was published in the Spokesman-Review and Shoshone News Press on June 13, 1992; reminders of the public meeting were placed in the Shoshone News Press on June 20, 21, 23, 24, and 25, 1992. The initial public comment period was from June 15 to July 15, 1992; it was extended to August 14, 1992 after a July 10 citizen request to extend the comment period was received. A public meeting was held on June 25, 1992. Comments from the public were taken and are summarized in the Responsiveness Summary portion of this document along with all written comments that were submitted during the comment period.

There has been a long history of community relations activities in the Silver Valley. Since discovery of elevated blood leads in children in 1974, the IDHW, Panhandle Health District (PHD), and the CDC have continually worked with area residents to reduce exposures to lead. In 1985 the Shoshone County Commissioners selected a nine member Task Force to serve as a citizen's advisory group to the Bunker Hill Superfund Project Team (comprised of representatives of U.S. EPA and IDHW and contractors). The PHD was contracted by IDHW to perform community relations tasks for the Site. A full time IDHW staff person has also been stationed onsite from mid 1987 to present. Part of the Task Force's duties is to assist in community relation activities when needed.

Community relations activities have focussed on maintaining effective communication between the citizens living on the Site and the agencies. Actions taken have been tailored to meet community needs and are consistent with the requirements of the federal law. They have provided an ongoing forum for citizen involvement in reaching the remedial action decisions prescribed in this ROD.

Between May 1985, and July 1991, the following meetings and community outreach activities were conducted:

Description	Count
Task Force Meetings	37
Meetings with Groups/ Civic Organizations	79
Meetings with Fair Share/ICN	18
Fact Sheets	25

Health Intervention Program Screenings	9

Information repositories have been created for the public to have access to minutes of task force meetings, all major project documents, fact sheets, orders, and other pertinent information. These repositories are located at the Kellogg Public Library, Kellogg City Hall, Pinehurst/Kingston Public Library, and Smelterville City Hall.

Generally, meetings were well attended. Task force meetings typically were composed of 20 - 50 community members. Proposed plan meetings were attended by over 150 citizens. Smaller group meetings were intended to get information to interested groups.

Specific Community Relations Activities at the Site are listed below. For those activities prior to May 1991, only the dates have been listed. For further details on these activities, refer to the Record of Decision on the Residential Soils (August 1991).

July 15, 16, 17, 1992	Notice ran in the Shoshone News Press announcing the extension of the Public Comment Period.
July 10, 1992	U.S. EPA released a Public Comment Period extension notice to people on the mailing list.
June 25, 1992	U.S. EPA conducted the Proposed Plan Public Meeting
June 20, 21, 23, 24, 25, 1992	A reminder of the public meeting ran in the Shoshone News Press.
June 13, 1992	Ad ran in the Shoshone News Press and the Spokesman Review, announcing the date and time of the public meeting and the public comment dates. The ad also briefly described the preferred alternative and encouraged comments on all alternatives from the proposed plan. Also explained where people could pick up copies of the entire plan.
June 13, 1992	The Agencies distributed the Proposed Plan fact sheet door to door in Smelterville, Wardner, Kellogg, Pinehurst, and the rest of the Superfund Site.
June 13, 1992	U.S. EPA mailed the Proposed Plan to the mail list and provided additional copies to the following locations: Superfund Project Office, Kellogg Library, Panhandle Health District Office, Pinehurst/Kingston Library, Kellogg City Hall, and Smelterville City Hall.

June 4, 1992	Regional Administrator and other representatives of U.S. EPA met with several community groups including the Task Force and the Kellogg Chamber of Commerce.
May 28, 1992	Task Force Meeting to discuss institutional control and interior dust remediation alternatives.
May 1992	Newspaper article ran in the Silver Valley Voice, which explained in detail the alternatives that were being considered for the Site.
April 30, 1992	Task Force Meeting to discuss the cleanup alternatives proposed for ground water and surface water.
March 19, 1992	Task Force Meeting to discuss CIA, smelter complex, MOA and Smelterville Flats cleanup alternatives.
February 26, 1992	Door to door distribution by the Agencies of a fact sheet, which outlined the project accomplishments from 1991 and announced the activities expected to occur over the spring and summer and project accomplishments that had taken place in 1991.
September 5, 1991	Door to door distribution by the agencies of a Fact Sheet announcing the cleanup plan for Residential Soils.
August 12, 1991	Door to door distribution by the Agencies of an updated Fact Sheet on the Hillsides Project.
May 23, 1991	Proposed Plan Public Meeting on Residential Soils Cleanup
April 26, 1991	The Proposed Plan for Cleanup of the Residential Soils Within the Site
February 28, 1991	Door to door distribution by the agencies of a Fact Sheet Update.
February 21, 1991	Task Force Public Meeting.
January 18, 1991	Fact Sheet explaining the 1990 accomplishments.
October 25, 1990	Task Force Public Meeting and Summary of Findings Risk Assessment/Data Evaluation Report (RADER) Populated Areas.
October 2, 1990	Fact Sheet released by U.S. EPA which discussed the Hillside Stabilization and Revegetation Order.

September 1990	U.S. EPA released a fact sheet which explained the CERCLA Process at Bunker Hill.
July 24, 1990	U.S. EPA released a general update on activities at the Site.
July 19, 1990	Task Force Public Meeting.
April 12, 1990	Task Force Public Meeting.
March 19, 1990	U.S. EPA released a fact sheet update on the proposed Page Pond disposal
February 26, 1990	Bunker Hill Superfund Site Fact Sheet
December 1989	Bunker Hill Superfund Site Fact Sheet
November 16, 1989	Task Force Public Meeting.
September 1989	Bunker Hill 1989 Residential Soil Removal Action Cost Summary through 9/29/89
August 24, 1989	Task Force Public Meeting.
May 18, 1989	Task Force Public Meeting.
March 1989	Panhandle Health District 1: Notice of Engineering Evaluation for Phased Clean-up comment.
February 16, 1989	Task Force Public Meeting.
December 15, 1988	Task Force Public Meeting.
October 19, 1988	Task Force Public Meeting.
September 8, 1988	Task Force Public Meeting.
September 1988	Bunker Hill Superfund Fact Sheet
July 28, 1988	Task Force Public Meeting.
July 1988	Bunker Hill Superfund Project Update
June 30, 1988	Task Force Public Meeting.

May 12, 1988	Task Force Public Meeting.
February 26, 1988	Letter to Silver Valley Task Force chairman concerning how U.S. and IDHW will proceed with the RI/FS process.
December 10, 1987	Task Force Public Meeting.
December 1987	Bunker Hill Superfund Project Update.
August 13, 1987	Task Force Public Meeting.
August 11, 1987	Letter to Interested Parties regarding RI/FS Bunker Hill Superfund Site
June 1987	Memo to Silver Valley Bunker Hill Superfund Task Force
June 18, 1987	Task Force Public Meeting.
May 1987	Status Report: Bunker Hill Superfund Project
April 16, 1987	Task Force Public Meeting.
March 9, 1987	Task Force Public Meeting.
March 1987	Bunker Hill Superfund Site Update
February 5, 1987	Task Force Public Meeting.
January 1987	U.S. EPA released a fact sheet explaining the Superfund Process.
December 11, 1986	Task Force Public Meeting.
September 18, 1986	Task Force Public Meeting.
August 7, 1986	Task Force Public Meeting.
July 1986	Memo to Silver Valley Superfund Task Force regarding Silver Valley Superfund Project
May 29, 1986	Task Force Public Meeting.
April 10, 1986	Task Force Public Meeting.
March 20, 1986	Task Force Public Meeting.

February 13, 1986	Task Force Public Meeting.
January 9, 1986	Task Force Public Meeting.
December 5, 1985	Task Force Public Meeting.
October 24, 1985	Task Force Public Meeting.
September 19, 1985	Task Force Public Meeting.
August 1, 1985	Task Force Public Meeting.
June 27, 1985	Task Force Public Meeting.
May 16, 1985	Task Force Public Meeting.

4 SCOPE AND ROLE OF OPERABLE UNIT

The rationale for separating the Bunker Hill RI/FS into two parts involved data availability and confidentiality issues associated with investigation of private residential properties within the Populated Areas. Both environmental and human health related data were collected as part of the epidemiological studies. Because of this the agencies believed that the Populated Areas RI/FS could best be completed by the agencies in order to honor confidentiality agreements with individuals and individual property owners.

The residential soil component of the Populated Areas was the first operable unit to be addressed in a ROD (August 1989). The other components related to the Populated Areas investigation that have not been addressed in a decision document include: residential interiors, commercial properties, and rights-of-way. The agencies originally expected to address these issues in a second ROD in 1992; however, the Potentially Responsible Parties (PRPs) proposed to the U.S. EPA and IDHW a Site Wide cleanup plan that comprehensively addresses concerns in both the Populated and Non-populated Areas. Subsequently, the Agencies decided to complete the Residential Soils ROD as scheduled, because soils are a primary risk to the residents; however, all remaining issues (see Table 2-1) were consolidated into a comprehensive FS performed by the PRPs with U.S. EPA oversight representing a second Operable Unit for the Site. That FS supports this second ROD for the Site.

Elements addressed in this ROD include:

- Hillsides
- Smelterville Flats
- Central Impoundment Area
- Page Pond
- Smelter Complex and Mine Operations Area
- Rights-of-Way
- Commercial Buildings and Lots
- Residential Interiors
- Future Development in Non-populated Areas
- Constructed Wetland Treatment Systems
- Public Water Supply Considerations
- Soil Action Levels
- Institutional Controls
- Monitoring
- Operations and Maintenance

The consolidation of these elements for investigative and remedy selection purposes recognizes the interrelationships among the geographic areas of the Site, transport media considerations, and the need to develop an integrated remedial action for the Site. Throughout the FS process, every effort was made to consider how remedial actions for each area would impact an overall remedial action for the Site. Development of the FS by the cooperating PRPs involved considerable dialogue with the agencies. Numerous meetings were held to focus technical evaluations of site contamination and evaluate cleanup options.

This ROD considers both the interrelated nature of the various Non-populated Areas, and the need to integrate residential areas into a site wide remedial action. For example the decision in the Residential Soils ROD to utilize removal and replacement of contaminated residential soils to a depth of one foot has impacts on site ground water that must be considered in evaluating that resource in subsequent investigations. The residential soils ROD also sets the stage for the utilization of institutional controls as a component of site wide remedial actions and appropriate remedies for onsite disposal of contaminated residential soils. Actions selected in this ROD complement the remedial actions selected in the Residential Soils ROD. Together this ROD and the Residential Soils ROD serve to prescribe a protective site wide remedy for the Bunker Hill Site. Studies conducted during the Residential Soils RI/FS, including the RADER, were factored into the decisions in this ROD. Response actions required by the existing U.S. EPA Orders for the Site are components of this ROD and are hereby incorporated into this ROD.

Actions selected in this Record of Decision do not address sources of contamination upgradient of the Bunker Hill Superfund Site, and while onsite actions are expected to have significant benefits to downgradient SFCDR water quality conditions over time, active remediation of the SFCDR is beyond the scope of actions specified in this ROD. The NCP gives U.S. EPA broad discretion to use not only CERCLA but also other appropriate authorities, to address releases of hazardous substances in the Coeur d'Alene Basin. Recently U.S. EPA, the State of Idaho, the Coeur d'Alene Tribe of Idaho and other federal, state and local agencies have initiated efforts to integrate water quality improvement programs in the Coeur d'Alene Basin. The Coeur d'Alene Basin Restoration Project efforts are expected to complement actions selected in this ROD in improving overall water quality conditions in the Basin. The Coeur d'Alene Basin Project is being designed to integrate and coordinate the activities within the Coeur d'Alene Basin which are being undertaken by the local landowners, local governments, state agencies, the Coeur d'Alene Tribe, the Federal Trustees and U.S. EPA. This includes coordination of regulatory authorities under the Clean Water Act (CWA), CERCLA, and RCRA. Other state, local and Tribal programs will also be integrated into this Project. The Clean Water Act provides a mechanism for developing water quality standards, evaluating discharge permits and establishing nonpoint source controls within the Coeur d'Alene Basin. CERCLA provides a mechanism for investigation and controlling the release of hazardous substances through the exercise of removal authorities.

5 SITE CHARACTERISTICS

5.1 PHYSICAL SETTING

The Bunker Hill Superfund Site consists of a seven-mile by three-mile section of the east-to-west trending valley of the South Fork of the Coeur d'Alene River (SFCDR). The topography of the valley, known as the Silver Valley, consists of an alluvial floodplain bordered on the north and south by steep mountains or hillsides. Floodplain width varies from about 0.1 mile east of Kellogg to approximately 0.9 miles near Smelterville. The elevation of the valley floor ranges from 2,160 feet above mean sea level at the west end of the Site to 2,320 feet at the eastern end of the Site. Typically, the valley floor is nearly level, with most slopes less than one percent. Mountains rising from the valley range from 500 to 2,500 feet above the valley floor. The mountainsides typically exhibit slopes of 45 to 90 percent and at some points exceed 110 percent. Numerous valleys and gulches cut through the mountains and generally trend north to south, intercepting the valley of the South Fork Coeur d'Alene River (SFCDR). The major drainages of the Site are on the south side of the Valley. These include Milo, Deadwood, and Government Gulches.

SOILS

Soils within the Site vary from poorly developed native colluvium and slope-wash materials on the hillsides to largely alluvial soils on the SFCDR valley floor.

Hillside area soils with slopes greater than 35 percent were generally formed in volcanic ash and metasedimentary rocks. Surface layers are typically 14 to 16 inches of gravelly silt loam with very cobbly loam subsoils extending more than 60 inches to weathered bedrock. In the Smelter Complex area, terrace deposits occur near the base of the hillsides and are formed in glacial and alluvial deposits. These soils typically have exposed subsoils consisting of silt loam and heavy silt loam underlain by very cobbly or very gravelly heavy silt loam and silty clay loam.

Hillsides in the immediate vicinity of the Smelter Complex are generally devoid of vegetation, resulting in conditions favorable to sheet, rill, and gully erosion. This erosion has resulted in substantial loss of material from the upper soil horizons.

Soils and surface materials on the SFCDR valley floor (including Smelterville Flats) vary in their physical characteristics and genesis from those on the hillsides, with some evidence of regional loess contribution. The valley floor soils and surface materials were impacted by the construction of a plank and pile dam at the west end of Smelterville Flats in the early 1910s which retained sediments, including tailings, until its failure in the 1930's. The tailings have been reworked and redistributed by the river since that time. Flooding of the SFCDR together with excavation of the tailings/alluvial mixture (jig tailings) for reprocessing has redistributed jig tailings and smelter emissions throughout most of the valley flood plain.

SURFACE WATER

The SFCDR below Wallace, located 12 miles east of Kellogg, is a relatively shallow stream with a gradient of about 30 feet per mile. Since mining activities in the area began, the SFCDR and some tributary streams in the Site vicinity or the Site, as well as upstream, and downstream areas, have received a sediment load which included mine/mill tailings.

Flow variations of the SFCDR are affected by spring snowpack melt. In a typical year, peak average monthly flows occur in April, May, and June, tapering off in later summer and early fall. In winter, flows are low unless an early snow melt or a large rainfall event occurs.

The drainage network of the Coeur d'Alene River (CDR) Basin includes Canyon Creek, above Wallace; Big Creek (including its east and west forks), between Osburn and Kellogg; Montgomery Creek; and, Pine Creek (including its east, middle, and west forks), near Pinehurst. There has been extensive mining activity in many of the tributaries upstream of the Site, in particular Canyon Creek, Nine Mile Gulch, and Big Creek. Tributaries within the Superfund Site include Milo, Italian, Jackass, Portal, Deadwood, Magnet, Government, Humboldt, Grouse, and Pine Creek Gulches.

GROUND WATER

Water bearing materials in the Site include: upper, confining, and lower zones. This system is important because of its hydraulic linkage with the SFCDR, relatively large ground water discharge rates and flow velocities, and potential to receive contaminants from overlying and integrated sources as well as upstream areas. Ground water is also known to be present, at least seasonally, in colluvial/alluvial deposits in tributary valleys and locally in terrace deposits along the south wall of the SFCDR Valley. Ground water systems are probably present in the hillsides along the bedrock/soil interface, particularly after precipitation and snow melt events. It is probable that a fracture-flow dominated ground water system exists within the bedrock underlying the Site (RI, 1992).

Major tributary valleys at the Site include Milo, Jackass, Italian, Deadwood, Magnet, Government, Grouse, Humboldt, and Pine Creek Gulches. Ground water in these gulches probably occurs in shallow, unconfined systems with steep hydraulic gradients; an exception to this is the Pine Creek drainage, which is relatively large with a flat floor. Potential recharge sources to these ground water systems include infiltration of precipitation and snow melt, leakage from streams, leakage from surface impoundments, and potential contribution from bedrock sources. Discharge from the tributary gulch ground water systems primarily enters the upper zone of the valley fill aquifer system.

From an environmental impact perspective, Government Gulch is one of the more important tributaries entering the SFCDR Valley because of numerous contaminant sources resulting from the Zinc and Phosphoric Acid Plants. Water levels in Government Gulch are typically highest in April and lowest in January and October. Although water levels varied by as much as seven feet, the horizontal hydraulic gradient tends to be relatively constant, indicating that water level fluctuations are fairly uniform within the Gulch. Relatively constant ground water flow gradients are expected in other tributary gulches. The estimated ground water gradient in Government Gulch is about nine times that noted in the upper zone of the SFCDR Valley.

VEGETATION

Forests in the Bunker Hill Superfund Site area are characteristic of the northern region of the Rocky Mountains, extending from southern Montana and Idaho to Jasper National Park in Alberta. Typical forest area species in the Site area include: western hemlock, western red cedar, mountain hemlock, and subalpine larch which are interspersed among ponderosa pine, lodgepole pine, douglas-fir, and subalpine fir.

Much of the Site vegetation has been modified by past disturbances and, consequently, forests on the Site are typically restricted to the upper elevations of the hillsides and areas near the perimeter of the Site (Pinehurst, Elizabeth Park, etc.). In general, vegetative cover increases with increasing distance from the Smelter Complex. The present site area includes barren areas (near the Smelter Complex), sparsely vegetated shrub land (peripheral to barren areas), natural forested areas (upper hillsides near the boundaries), swamps (southwestern portion of Smelterville Flats), plantations of young conifers (areas planted by the Bunker Hill Company), and urban vegetation (residential areas).

CLIMATE

The meteorology of the Site is dominated by mountain/valley drainage winds related to the local topography. Wind patterns in the SFCDR Valley generally follow a daily recurring upvalley/downvalley (easterly/westerly) flow regime. Typically, night cooling of the ground layer leads to a surface-based atmospheric temperature inversion, producing a down-valley flow of air. After sunrise, heating of the valley floor and hillsides causes a reversal of the earlier wind pattern, although not as strong. During the transition period between the two wind directions, winds are generally calm in the valley. At other times, because of the sheltering effects of the SFCDR Valley location, wind speeds are typically lower in the valley than more exposed areas such as hillsides. Construction of a wind frequency distribution/magnitude plot shows the influence of strong regional west to east winds (see Figure 3-31 of RI, Volume 1).

The Bunker Hill Site receives some of the highest levels of precipitation in Idaho. Normal annual precipitation in the SFCDR valley floor area (Kellogg) is approximately 30.4 inches. Total annual precipitation at Kellogg typically has a relatively small range of 20 to 40 inches, with extremes of 47.6 inches in water year 1974 to 17.4 inches in water year 1973. Mean annual snowfall for the period of record in Kellogg was 69.9 inches. Average annual precipitation at higher hillside elevations can exceed 50 inches (RI, 1992). An average of 70 percent of the annual precipitation at Kellogg occurs from October to April, mainly as snowfall.

At higher elevations, snow normally persists from late fall to late spring. The Bunker Hill Site area is positioned to receive straight zonal flow of warm Pacific moisture from the west. Resulting precipitation from this system in combination with a melting snowpack have produced some of the largest floods in the SFCDR Basin; these have occurred during the winter months.

The Bunker Hill Site is in the climate region termed "highland climates", and is dominated by mountain-valley climate characteristics such as upvalley/downvalley wind regimes. This is accompanied by considerable variation in snowfall with elevation and location. The mean annual temperature for the period 1951 to 1980 was 47.2°F. The record extreme temperatures were 111°F (August 5, 1961) and -36°F (December 30, 1968). On the average, 28 days per year reach a maximum temperature of 90°F or greater, and 143 days reach a minimum of 32°F or lower (RI, 1992).

CULTURAL SETTING

The Bunker Hill Superfund Site encompasses four incorporated cities (Kellogg, Pinehurst, Smelterville, and Wardner) and three communities (Elizabeth Park, Page, and Ross Ranch). About 5,000 residents live within the Site. Settlement of the valley was associated with the development and growth of the metal mining and smelting industries. Homes and business were constructed throughout the valley floor and side gulches. As a result, local populations live to varying degrees in close proximity to contaminated media and sometimes contaminant sources. For example, many valley floor residences have been constructed on tailings, resulting in contaminated yard soil. Smelter emissions also caused widespread contaminant dispersion, resulting in contaminated yard soils and interior dusts. The pervasive nature of Site contamination and the close association of the resident population requires remedial actions that retain the integrity of the residential community while addressing contaminant exposure pathways.

5.2 NATURE AND EXTENT OF CONTAMINATION

5.2.1 Contaminants of Concern

Adverse environmental impacts have and continue to occur from heavy metals and other contaminants associated with mining, milling, and mineral beneficiation and processing activities. The Site Characterization Report (SCR) listed thirteen contaminants of concern based on preliminary investigations including the following:

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Cobalt
- Mercury
- Selenium
- Silver
- Zinc
- Asbestos

- Copper
- Lead
- Polychlorinated Biphenyls (PCBs)

Work conducted subsequent to the SCR and as proposed by the Non-populated RI/FS Work Plan addressed these principal contaminants along with an extensive screening program for the presence of other contaminants of concern, including organic compounds. Task 0 of the RI sampled for the priority pollutant list and 10 other constituents. Task 0 activities entailed collection of solid and liquid samples for broad-spectrum contaminant screening at the onset of the RI. Evaluation of the analytical results was completed in conjunction with a review of field records, historical records, and process, product, and by-product material information. During the RI, no additional contaminants of concern were identified. Manganese is listed as a contaminant of concern in the Ecological Risk Assessment (ERA) because of the potential impact to small mammals from localized soils; additionally, manganese was identified in the Risk Assessment Data Evaluation Report (RADER) as exceeding Secondary Drinking Water Standards (DWS) in some instances. Some contaminants of concern were not detected in surface or ground water during the screening process and thus were eliminated from further water analyses. Beryllium, PCBs, and asbestos analyses were not routinely conducted on surface or ground water samples, and antimony and copper analyses were not routinely conducted on ground water samples since screening determined these constituents to be below levels of concern.

5.2.2 Contaminant Sources

The presence of contaminants at the Site was traced to the following contaminant sources and source areas identified during the RI:

- <u>Jig Tailings</u> - In the early years of operation, mills within the Site and, for a longer period, mills upstream of the Site, released tailings, a waste product from the ore concentrating process, which were deposited on the valley floor. During flood events, these tailings were transported by the SFCDR, mixed with alluvium, and deposited on the flood plain. The valley floor throughout the Site is currently mantled with a mixture of jig tailings, flotation tailings, and alluvium, as well as air dispersed contaminants from the Smelter Complex. The mixture is referred to as "jig tailings" for the purpose of the RI/FS. Jig tailings were identified as a source of Site wide metals contamination in soil, air, surface water, and ground water.

- <u>Flotation Tailings</u> - Crude flotation ore concentration methods were used at the Site as early as 1913. Froth flotation was the predominant method of ore concentration after approximately 1930. The byproducts of this ore concentration process are called flotation tailings. The release of tailings from the Page Mill to the Page tailings impoundment began in 1926. Flotation tailings for the Bunker Hill Mill were deposited on the valley floor until the West Mill began discharging to the Central Impoundment Area (CIA) in 1928. Uncontrolled releases of flotation tailings in upstream areas continued until as late as 1968; these tailings comprise a portion of the alluvium/tailings mixture (jig tailings) on the SFCDR Valley floor. Flotation tailings impounded in the CIA and Page Pond were recognized as sources of metals contamination in air, surface water, and ground water.

- Inflow of Contaminants at the Upstream Site Boundary - Mining and milling operations were conducted upstream of the eastern site boundary during the same period as those conducted within the Site. The RI documented the degradation of surface and ground water quality upgradient of the Site, and identified the influxes of metals in surface and ground water at the eastern Site boundary as sources of contamination within the Site.

- Air Emissions - The Lead Smelter began operations in 1917, and Zinc Plant production began in 1928. Particulate controls were employed to capture and recycle the Lead Smelter and Zinc Plant flue dusts, but sulfur dioxide emissions were not directly addressed until sulfuric acid plants were constructed in 1954 and 1965 (Zinc Plant) and 1970 (Lead Smelter). Emission controls were not consistently effective, and operational upsets occurred, in particular after the 1973 baghouse fire. Smelter Complex air emissions, including fugitive emissions, were identified as sources of lowered pH and heavy-metal concentrations in soils throughout the Site, and contributed to vegetation damage and erosion on hillside slopes.

- Smelter Complex Materials and Residuals - Ores, concentrates, flue dusts, sinter and calcine (products of roasting concentrates), lead residues, slag, gypsum, other materials, and wastes were stored, transported, and occasionally spilled in and around the Smelter Complex. Material accumulations and residual materials within the complex were identified as sources of air, surface water, and ground water contamination. The Smelter Complex had the highest concentrations of contaminants of any area within the Site.

- Gypsum and Slag - Gypsum generated during phosphoric acid production was disposed in three impoundments that were identified as sources of blowing dusts and inorganic non-metal contaminants in surface and ground water. Large quantities of granulated slag were deposited in the CIA west cell. The granulated slag was produced by the zinc fuming process wherein most of the zinc was removed as zinc oxide. Small quantities of ungranulated slag were deposited adjacent to the lead smelter. The ungranulated slag was not subjected to the zinc fuming process and therefore contains a greater abundance of zinc than the granulated slag. The remaining metals in the granulated and ungranulated slag are relatively immobile in their current state due to their incorporation in a silicate matrix.

- Acid Mine Drainage - Dewatering of the Bunker Hill Mine has contributed acidic, metals-laden mine water to the east cell of the CIA. Most dewatering was curtailed in early 1991; however, it is likely that full scale dewatering will resume in the future. Seepage from the east cell was identified as the largest source of metals loading to Site ground water during the RI.

Full-scale smelting operations at the Site ceased in 1981, although salvage efforts, including sporadic open-pot smelting, were reported in the mid-1980s. Mining and milling operations have operated at the Site intermittently since 1981, but were curtailed in early 1991. Therefore, new contaminants are no longer being generated onsite with the exception of continued mine discharge. However, contaminants continue to enter ground water and surface water at the upstream Site boundary. Additional contaminants will be generated onsite and will increase if dewatering of the Bunker Hill Mine is resumed or when water flows naturally from the mine. The redistribution of contaminants from existing sources by air, surface water, ground water and anthropogenic activities continues to impact onsite and offsite areas.

A description of the nature and extent of contamination by media and current contaminant transport pathways as characterized during the RI are provided in the following sections.

SOILS AND SURFICIAL MATERIALS

Soil contamination exists in most areas of the Site. Contaminant concentrations in Site soils are generally highest in and adjacent to the Smelter Complex. Table 5-1 summarizes maximum soil metals concentrations exhibited within the Bunker Hill Superfund Site. Soil metals concentrations were compared with background levels established for the Coeur d'Alene Mining District by the U.S. Geological Survey (Gott and Cathrall, 1980). "Threshold levels" were established as a basis for locating ore deposits.

HILLSIDES

Metal concentrations in undisturbed hillside soils throughout the Site were generally elevated above the threshold levels. The highest metals concentrations in the hillside soils occurred in the uppermost few inches of soil profile; metals concentrations generally decreased sharply with depth. Table 5-2 summarizes average metal concentrations for all zones at 0-1" depth in the Hillsides and the vicinity around the Smelter Complex area. Sources of hillside soil contaminants included historical Lead Smelter and Zinc Plant air emissions, wind-mobilization and subsequent deposition of fugitive dust from material accumulations and residuals in the Smelter Complex, and deposition of wind-blown tailings. Erosion of contaminated soils was identified as a contaminant transport mechanism during the RI and has resulted in a reduction of surface soil concentrations in some areas.

SMELTERVILLE FLATS

Jig tailings were widely distributed on the valley floor throughout the Site; these deposits contain elevated metals concentrations compared to threshold levels. The largest accumulation of jig tailings within the project area is on Smelterville Flats, where contamination ranges to depths of three to seven feet, with local accumulations approaching ten feet in thickness. Jig tailings also underlie the CIA and portions of the Page Swamps. In general, concentrations in the jig tailings are dependent on the relative quantities of tailings and alluvium in the mixture. Maximum concentrations of 504 mg/kg arsenic, 78.2 mg/kg cadmium, 30,000 mg/kg lead, and 15,600 mg/kg zinc were measured in valley floor jig tailings samples.

Table 5-1

Maximum Metal Soils Concentrations (mg/Kg) by Subarea

Areas	Arsenic	Cadmium	Lead	Zinc
Hillsides[a]	300	245	14,400	16,100
Smelterville Flats	504	78.2	30,000	15,600
CIA[b]	692	51.8	7,760	23,600
Page[c]	202	38.7	4,350	4,260
Smelter Complex[d]	160,000	127,000	860,000	754,000
MOA	44,300	3,630	651,000	170,000
Background[e]	< 10	0.8	43	95

a includes areas around the Smelter Complex.
b includes the CIA East, Middle, and West cells.
c average concentrations.
d includes Lead Smelter area, Magnet Gulch/Deadwood Gulch areas, Phosphoric Acid/Fertilizer Plant areas, and Zinc Plant area.
e Source: Gott and Cathrall, 1980.

Table 5-2

Soil Average Concentrations (mg/kg) for All Zones at 0-1" Depth

AREAS	ARSENIC		CADMIUM		LEAD		ZINC	
	AVE.	RANGE	AVE.	RANGE	AVE.	RANGE	AVE.	RANGE
Hillside Zones[a] (1-39)	43.3	< 3.0 - 207.0	10.7	4.3 - 36.0	1,376.9	122 - 15,600	456	166 - 1,110
Hillside Zones[b] (40-49)	117.6	46.6 - 300.0	57.8	13.0 - 181.0	5,356	1,890 - 13,700	4,055	943 - 16,100

a Zones 1 through 39 include areas within the Bunker Hill Site.
b Zones 40 through 49 include those areas around the defunct Smelter Complex.

TAILINGS IMPOUNDMENTS

The CIA and the Page Pond tailings impoundments contain a total of approximately 18 million cubic yards of flotation tailings. For the CIA flotation tailings, maximum measured arsenic and cadmium concentrations (692 mg/kg and 45.2 mg/kg, respectively) occurred in surficial dust samples. Maximum measured lead and zinc concentrations (7,760 mg/kg and 7,990 mg/kg, respectively) occurred in composite core samples. IDHW characterized Page Pond as a dust source by averaging concentrations from individual dust samples. Averages of measured concentrations from Page Pond surface samples were 202 mg/kg arsenic, 38.7 mg/kg cadmium, 4,350 mg/kg lead, and 4,260 mg/kg zinc.

GYPSUM

Gypsum (calcium sulfate) generated during the production of phosphoric acid was disposed in impoundments in upper Magnet Gulch, on the valley floor near the mouth of Magnet Gulch, and in the CIA middle cell. The gypsum contains relatively low metals concentrations but was found to be readily soluble and was identified as a source of sulfates, fluoride, and other inorganic non-metal constituents (Table 5-3). The A-4 and A-5 Gypsum ponds are potential source areas for fluoride although it was not analyzed during the RI.

Table 5-3

Maximum Concentration(in mg/kg)
for Selected Parameters in Gypsum Samples

Parameter	A-4 Mean Value	A-5 Mean Value	Background[a]
Arsenic	4.8	4.8	< 10
Cadmium	5.4	6.9	0.8
Lead	39.7	128	43
Zinc	33.6	216	95
Carbonate	6,190	6,090	--
Sulfate	395,000	405,000	--
Sulfur-Total	159,000	164,000	--

[a] Source: Gott and Cathrall, 1980

SLAG

Granulated slag in the CIA west cell contains highly elevated concentrations of metals. However, these metals are generally regarded as being immobile and unavailable for transport due to their incorporation in a silicate matrix, which limits leaching, and the relatively large particle size of the slag, which limits wind transport. Maximum metals concentrations measured in the granulated slag were 172 mg/kg arsenic, 51.8 mg/kg cadmium, 5,850 mg/kg lead, and 23,650 mg/kg zinc.

MATERIAL ACCUMULATIONS

Discrete accumulations of various high-concentration products, by-products, residues, and wastes are present in indoor and outdoor areas within the Smelter Complex. Indoor accumulations are sheltered and subject to limited dispersal, except where structures are in poor condition. Outdoor material accumulation sites have contributed to soil, surface water, and ground water contamination. Soil contamination is generally greatest adjacent to and underlying the various sites and may extend to depths of several feet where infiltration and earthwork have occurred. The largest material accumulation pile in the Smelter Complex noted during the RI was the copper dross flue dust pile (CDFDP) in lower Magnet Gulch. The CDFD was sprayed with surface sealant during the RI to reduce its potential as a wind-blown dust source; the CDFD was subsequently relocated to the Lead Smelter during Spring 1992. Salvage of contaminated materials from the Smelter Complex with subsequent transport to offsite areas was identified during the RI as a contaminant dispersal mechanism, as was transport of contaminated dust and mud on vehicles. Imminent threats associated with the Smelter Complex are currently being addressed by the Smelter Complex owners, as required by the September 1991, Administrative Order.

Some isolated occurrences of oil-stained soils in the Smelter Complex contained PCBs in concentrations ranging from non-detectable to as high as 218 mg/kg near the Lead Smelter's water softening building. Numerous pieces of PCB-containing electrical equipment were removed and disposed of from the Bunker Hill Mine. Asbestos containing materials (ACM) were identified in some Smelter Complex buildings and equipment (e.g., insulations, roofing, and siding materials). Most of the loosened and damaged ACM at the Smelter Complex was removed during a 1989 CERCLA removal action.

AIR

Wind-mobilization and redistribution of contaminants from soils and surficial materials was identified as a major site wide transport pathway impacting the Populated areas of the Site.

Historical data collected by IDHW indicated that prior to the lead smelter and zinc plant closures, airborne lead was the primary contributor to elevated blood lead levels in human populations at the Site. Construction of the sulfuric acid plants and tall stacks (1977) resulted in significantly decreased sulfur dioxide and lead concentrations in onsite air. Lead and total suspended particulates (TSP) concentrations decreased further, following closure of the Smelter Complex. However, sources of wind-blown contaminants remaining at the Site include the CIA, Smelterville Flats, the Mine Operations Area (MOA), Smelter Complex facilities and properties, Page Pond, parking lots, railroad ROW, and other public and commercial facilities.

RI air quality data were collected from the Smelterville and Kellogg Middle School areas between November 1987 and November 1988. Maximum daily TSP concentrations were measured at the two school stations during a September 1988 dust storm. Weekly TSP concentrations at the two stations averaged 69.5 $\mu g/m^3$ and 40.8 $\mu g/m^3$, respectively. Weekly maximum and mean lead concentrations at the Smelterville station were reported at 1.35 and 0.312 $\mu g/m^3$, respectively; and the weekly maximum and mean lead concentrations at the Kellogg Middle School were reported at 0.310 and 0.095 $\mu g/m^3$, respectively. In general, higher lead concentrations in air correlate with higher TSP concentrations, and the highest TSP and metal concentrations were occasionally reported during the winter months. The National Ambient Air Quality Standard (NAAQS) for TSP (150 $\mu g/m^3$) was occasionally exceeded at the Smelterville and Kellogg Middle School stations during high-wind events. The NAAQS for lead (1.5 $\mu g/m^3$ and 0.5 $\mu g/m^3$ proposed) is based on the three-month average of daily lead concentration measurements. This standard was not exceeded at either monitoring station during the RI.

Fugitive dust model (FDM) predictions indicate that air transport pathways impact the populated areas of the Site. Dust source data from the summer of 1988 were used to predict the contributions to airborne lead concentrations during wind-blown dust events at six populated area receptor zones from specific sources within the Site. The results of the model simulations are discussed below.

- Smelterville Flats Sources - Receptor sites in Smelterville and lower Government Gulch were predicted to receive 88 percent and 53 percent, respectively, of their airborne lead concentrations from dust sources in Smelterville Flats. Approximately 28 and 23 percent of the lead transported to the receptor zones of northwest and northeast Kellogg, respectively, was also attributed to this source area.

- CIA Sources - CIA dust sources were predicted to contribute approximately 21 percent of the airborne lead concentrations in northwest Kellogg and less than 10 percent to other receptor zones within the Site.

- Smelter Complex Sources - Sources in the MOA were predicted to contribute approximately 65 percent of the airborne lead in west and south Kellogg and Wardner. Southeast Kellogg may receive over 30 percent of its airborne lead concentrations from the MOA. The Lead Smelter lead contribution to lower Government Gulch was estimated at approximately 22.5 percent. Other Smelter Complex sources accounted for less than 10 percent of the predicted lead levels at the other receptor zones.

- Hillside Sources - FDM predictions indicated that source areas on hillside slopes contributed approximately 26 percent and 16 percent of the total airborne lead concentrations at receptor sites in southeast and northeast Kellogg, respectively. The hillsides were predicted to contribute less than 10 percent of the total airborne lead in the other receptor zones.

Dusts that are dispersed from the sources described above may ultimately be resuspended and redistributed to other areas of the Site or offsite areas.

Since completion of RI field investigations, an increase in Site vegetative cover has been observed and measures have been taken to reduce potential fugitive dust generation that may result in an overall reduction of wind-blown contaminant transport.

SURFACE WATER

During the RI, baseline and runoff surface water quality samples were collected from stations along the SFCDR, perennial tributary gulches, and other locations throughout the Site. The collected data show that surface water entering the Site is of poor quality and is further degraded by a variety of inputs within the Site boundaries. Comparison of baseline data collected by U.S. EPA during the early and mid-1980s with those collected during the RI indicate an overall improvement in the water quality of the SFCDR within the Site.

The RI surface water data were compared with Federal Primary and Secondary Drinking Water Standards (DWS) and Aquatic Life Criteria (ALC; both Chronic and Acute). Surface water transport pathways were quantified in the RI Report in terms of combined metals loadings (CML) expressed in pounds per day (lb/day). CML was defined as the sum of the reported concentrations of arsenic, cadmium, cobalt, lead, and zinc multiplied by the volumetric flow rate and appropriate unit conversion factors.

The DWS and/or Chronic ALC for lead, cadmium, and zinc were commonly exceeded under baseline flow conditions at stations upgradient and within the Site. Table 5-4 compares ALC to both low flow and high flow concentrations for zinc, cadmium, and lead at various locations. Maximum baseline cadmium, lead, and zinc concentrations recorded at Elizabeth Park upstream from the Site boundary were 0.015 mg/l, 0.057 mg/l, and 2.22 mg/l, respectively, whereas the maximum concentrations of those metals reported at the downstream Site boundary were 0.017 mg/l, 0.188 mg/l, and 2.76 mg/l, respectively. In general, most constituent concentrations were higher during baseline low-flow conditions in late summer and fall than during higher flow conditions. During storm runoff events, maximum concentrations of total arsenic, cadmium, lead, and zinc in the SFCDR at the western (downstream) Site boundary were 0.045 mg/l, 0.047 mg/l, 0.931 mg/l, and 4.09 mg/l, respectively. Nearly all SFCDR runoff samples exceeded the DWS and Chronic ALC for cadmium, lead, and zinc, while arsenic concentrations were generally below Chronic ALC and DWS levels. Increased metal concentrations in the rising limb of the discharge hydrograph were attributed to the scouring of metal-laden materials from the stream bed and other source areas during the initial phases of runoff events.

Table 5-4

Bunker Hill Surface Water Contamination

STREAM	STATION LOCATION	LOW AND HIGH FLOW CONCENTRATIONS OF METAL CONTAMINANTS, 1987 - 1988 [Total, mg/l]					
		ZINC		CADMIUM		LEAD	
		LOW	HIGH	LOW	HIGH	LOW	HIGH
SFCDR	Elizabeth Park (SF2)	2.17	0.731	0.015	0.005	0.012	0.022
SFCDR	Valley (SF5)	2.52	0.936	0.012	0.007	0.035	0.021
SFCDR	Below Pine Creek (SF8)	2.39	0.668	0.010	0.006	0.039	0.188
Government Gulch	Near Mouth (GG3)	5.92	3.8	0.293	0.153	0.036	0.022
Milo Creek	At Mouth (MC2)	0.357	0.882	<0.002	0.005	0.061	0.240
Grouse Creek	Above East Swamp (GC1)	0.086	1.38	0.001	0.008	0.007	0.060
Humboldt Creek	Above West Swamp (GC1)	0.523	1.40	0.004	0.007	0.005	0.025
Pine Creek	Near Mouth (PC2)	0.110	0.071	<0.002	<0.004	<0.019	<0.005
FEDERAL WATER QUALITY CRITERIA (chronic), mg/l aquatic life [100 mg/l hardness]		0.110		0.0011		0.0032	

Surface water transport was identified as a major migration pathway for contaminants in the dissolved and solid phases within and exiting the Site. Although concentrations of contaminants do not vary greatly between the upgradient and downgradient Site boundaries, a combination of contaminant contributions and increased flow significantly increase the metal loadings leaving the Site. Baseline CML estimates for the SFCDR at the western (downstream) Site boundary under low-flow conditions (September 1987) and under high-flow conditions (May 1988) were 959 lb/day and 7,200 lb/day, respectively. CML sources to the SFCDR identified during the RI included the following:

- Inflows from upstream of the eastern Site boundary. CML estimates ranged from 633 to 3,420 lb/day;

- Upper zone ground water inflows in gaining reaches of the SFCDR. The estimated net CML from ground water to the river was 657 lb/day in September of 1987; over 400 lb/day of this loading was estimated from seeps in the south bank of the SFCDR near the CIA;

- Erosion, transport, and dissolution of contaminants in stream-bed and bank materials, contaminated soils, and material accumulations and residuals within the Site;

- Perennial tributary streams impacted by mining, milling, or smelting operations. Estimated CML under baseline conditions were 1.96 to 68.7 lb/day for Milo Creek, 2.46 to 67.7 lb/day for Bunker Creek, 2.02 to 101 lb/day for Government Creek, and 3.52 to 153 lb/day for Pine Creek;

- Discharges from the Page Pond and Smelterville wastewater treatment plants. CML estimates were 2.03 to 6.86 lb/day and 0.045 to 7.15 lb/day, respectively; and

- Stormwater runoff from the Smelter Complex and hillsides was identified as contributing large pulses of contaminants to the surface water system. Some of this runoff is routed to the CIA through drainage pipes and channels; however, a portion of the runoff from Government, Magnet, and Deadwood Gulches, MOA, Lead Smelter, Zinc Plant, and Phosphoric Acid/Fertilizer Plant enters Bunker or Government Creeks and ultimately the SFCDR.

GROUND WATER

A water well inventory indicates that a few residences rely on well water; most of the residences within the Site receive potable water from a municipal supply obtained from areas upgradient of contamination. Therefore, ground water at the Site is generally not used as a source of drinking water, and industrial use of Site ground water currently occurs infrequently. RI data indicate that the Site ground water has been contaminated by the previously described sources. Ground water quality data were compared with Federal Primary and Secondary Drinking Water Standards as a means of interpreting monitoring results and evaluating the impacts of Site contamination to the ground water system. CMLs for ground water were estimated as a means of assessing the relative contributions of specific source areas to the upper zone of the SFCDR Valley ground water system. RI data indicate that the DWS for cadmium and zinc were exceeded in most monitored areas of the upper zone; the cadmium DWS was exceeded near the east Site boundary, indicating an impact from upgradient sources. Exceedances of arsenic and lead in the upper zone were localized in the CIA and Page Pond areas. The DWS for cadmium was exceeded in lower zone ground water in the Kellogg and Smelterville Flats areas. The zinc secondary standard was exceeded in the lower zone in a small area near Portal Gulch and in the area from the mouth of Magnet Gulch to Pinehurst Narrows.

Measured concentrations of arsenic, cadmium, cobalt, lead, and zinc in all monitoring well samples were averaged over four sampling periods. The maximum average values are summarized in Tables 5-5 and 5-6 as follows:

Table 5-5

Maximum Average Concentrations in Upper Zone Ground Water

Analyte	Primary (1) and Secondary (2) DWS mg/l	Maximum Average Conc.[a] mg/l	Well Number	Well Location
Arsenic	0.05 (1)	0.154	GR-8	SW Corner, CIA Middle Cell
Cadmium	0.005 (1)	0.539	GR-8	SW Corner, CIA Middle Cell
Cobalt	NS[b]	0.067	GR-3	North of CIA West Cell
Lead	0.005 (2)	0.403	GR-52U	Concentrator Area
Zinc	5 (1)	50.5	GR-60	SE Corner, CIA Middle Cell

a Concentration data collected from each monitoring well during the RI were averaged over four sampling periods. "Maximum Average Concentration" indicates the largest average concentration noted for any of the wells sampled.
b NS: No Standard for Cobalt.

Table 5-6

Maximum Average Concentrations in Lower Zone Ground Water

Analyte	Primary (1) and Secondary (2) DWS mg/l	Maximum Average Conc.[a] mg/l	Well Number	Well Location
Arsenic	0.05 (1)	ND[b]		
Cadmium	0.005 (1)	0.307	GR-1LS/LD	Mouth of Government Gulch
Cobalt	NS[c]	ND		
Lead	0.005 (2)	ND		
Zinc	5 (1)	18.7	GR-1LS/LD	Mouth of Government Gulch

a Concentration data collected from each monitoring well during the RI were averaged over four sampling periods. "Maximum Average Concentration" indicates the largest average concentration noted for any of the wells sampled.
b ND: Not Detected During the RI.
c NS: No Standard for Cobalt.

DWS for cadmium, lead, zinc, fluoride, and sulfate were exceeded in one or more monitoring wells in Government Gulch and other wells in the Smelter Complex (See Table 5-7). The poorest ground water quality observed at the Site occurred in upper Government Gulch south of the Zinc Plant and was probably associated with leaching of metals from a former materials storage area.

CMLs for ground water were estimated as a means of assessing the relative contributions of specific source areas to the upper zone of the SFCDR Valley ground water system. The estimated ground water CML at the western (downgradient) Site boundary was approximately 208 lb/day based on September 1987 RI data. The sum of the CMLs entering the SFCDR Valley system from upgradient and from onsite sources was estimated at approximately 986 lb/day. However, the surface and ground water systems in the SFCDR valley are linked by three identified gaining river reaches and two losing reaches. The net effect of these multiple losing and gaining reaches is a CML transfer from the ground water system to the SFCDR; this transfer was estimated at 657 lb/day based on September 1987 data presented in the Task 3 Data Evaluation Report.

Table 5-7

Ground Water Concentrations in Government Gulch

Sample Location	Maximum Concentrations in mg/L				
	Cadmium	Lead	Zinc	Fluoride	Sulfate
GR-1US	0.25	<0.025	17.4	10.9	853
GR-1UD	0.462	<0.025	24.1	9.57	917
GR-1LS	0.615	0.017	31.7	4.74	333
GR-1LD	0.086	0.012	11.1	1.01	279
GR-32S	0.648	0.451	20.50	1.09	166
GR-32D	0.008	0.006	0.347	0.10	94.1
GR-36	27.8	0.017	662	0.698	1350
Drinking Water Standards	0.01 (1)	0.05 (1)	5.0 (2)	4.0 (1)	250 (2)

(1) Denotes Primary Standards
(2) Denotes Secondary Standards

Approximately 75.8 lb/day of CML was transported in ground water across the eastern Site boundary from upgradient source areas based on September 1987 data. The largest onsite ground water loading source was seepage from the ponded area of the CIA east cell through flotation tailings; the CML in this seepage was estimated at 683 lb/day. Site wide infiltration through jig tailings deposits was estimated to be the second largest loading source at 168 lb/day. Discharge from the Government Gulch tributary system to the upper and/or lower zones of the valley system was estimated at 14.5 lb/day, and all other sources were each estimated to contribute less than 10 lb/day to the valley fill upper and lower zone aquifers.

6 SUMMARY OF SITE RISKS

6.1 HUMAN HEALTH RISKS

Risks to human health associated with exposures in the Non-populated Areas Site media were evaluated in the Human Health Risk Assessment (June 1992) (HHRA). This evaluation was third in a series of risk assessment efforts addressing both the Populated and Non-populated portions of the Site. All exposures for this Site were evaluated either as baseline or incremental. Baseline refers to exposure resulting from activities common to all members of the resident population. Incremental exposures result from potentially high risk activities by some members of the local population or visitors to the area. Risk associated with baseline activities of the resident population were addressed in the RADER (October 18, 1990). Potential baseline exposures evaluated in the RADER included ingestion of residential surficial yard soils and house dusts, inhalation of particulate matter, and consumption of water from local public supplies. Incremental activities evaluated in the RADER included potential consumption of local ground water, ingestion of soils from severely contaminated areas, extreme ingestion rates of soils/dusts by children (pica-types behavior), consumption of local fish and garden vegetables, and inhalation of outdoor airborne particulate matter during episodic high wind conditions.

Unacceptable risk levels in the populated area were associated with several of these exposures. Actions addressing cleanup of residential soils, house dusts, and fugitive dusts were developed in the Residential Soils ROD and the 1991 and 1992 Administrative Orders.

Risks associated with potential exposures in the Non-populated Areas were evaluated as incremental to assumed post-remedial baseline exposures in the Populated Areas.

Contamination of Site media is extensive throughout the Non-populated Areas. Contaminants of concern in all media include antimony, arsenic, cadmium, copper, lead, mercury, and zinc. Additional concerns may be expressed with respect to asbestos, cobalt, (PCB), and particularly mercury compound exposures to workers in the abandoned industrial complex. Potential risks resultant from the latter exposures were not quantified in the HHRA because they were detected only in localized areas within the individual complexes.

Contaminated media in the Non-populated Areas include soils and dusts, sediments, surface water, air, and ground water. The highest contaminant concentrations are noted in residual material accumulation piles, buildings, and process facilities throughout the Smelter Complex.

Ground water and surface water contaminant concentrations exceed drinking water maximum contaminant levels (MCLs) and aquatic life criteria (ALC) throughout many areas of the non-populated areas.

Contaminant migration is ongoing throughout the Non-populated Areas. Airborne, surface and ground water, and mass movement pathways are all active and continue to redistribute residual metals across the Site.

Potential risks were addressed in two major categories including:

- Risks associated with contaminant migration from Non-populated Areas sources into the residential portions of the Site where the general population is exposed; and,

- Incremental risks associated with direct contact with contaminated media by members of the population engaged in specific activities.

With respect to human health issues, the most significant contaminant transport phenomena are:

- Airborne dusts that result in excess respiratory cancer risk from arsenic and cadmium, and redistribute particulate lead to residential soils and house dusts that are a source of excess lead absorption in the resident population.

- Contaminated ground water that exceeds MCLs and presents excessive carcinogenic and non-carcinogenic risk through potential ingestion of arsenic, cadmium, manganese, lead, and zinc.

- Surface water transport of dissolved metals and contaminated sediments that can redistribute lead and other metals to areas accessible by the local population.

With respect to direct contact with contaminated media, the most significant concerns are associated with exposures related to potential land use in the Non-populated Areas. Risk scenarios were evaluated for future residential, recreational, and occupational use of the Non-populated Areas. Both carcinogenic and (chronic and sub-chronic) non-carcinogenic risks were evaluated. The Non-populated Areas were divided into geographic sub-divisions for the HHRA analysis. Those sub-divisions were:

- Hillsides
- Smelterville Flats
- Smelter Complex
- Mine Operations Area
- Page Ponds
- CIA

Table 6-1 summarizes route specific carcinogenic risk for the baseline population. Incremental carcinogenic risks exceeding acceptable criteria were observed for arsenic in ground water, in soils for children exhibiting pica-type behavior in several areas, and for adult occupational scenarios in the industrial complex and other highly contaminated areas of the Site.

Unacceptable Chronic non-carcinogenic risks (i.e., those exceeding Hazard Indices (HI) of 1.0 per U.S. EPA 1989) are summarized in Table 6-2.

Sub-chronic non-carcinogenic risk was evaluated for lead exposures to children and pregnant women. For children a biokinetic modeling methodology was employed. That analysis identified soil lead levels exceeding 1000 mg/kg as a threshold cleanup level for residential soils (CH2M HILL 1991). Geographic sub-units of the Non-populated Areas were evaluated against the criteria as shown in Table 6-3.

Summary risk assessment findings for future use scenarios for the Non-populated Areas sub-units follow:

- With respect to potential residential development, some hillside areas remote from the industrial complex meet the soil lead cleanup criteria established in the Residential Soil ROD. No other areas were suitable for residential development at current contaminant levels.

- Any portion of the Non-populated Areas not suitable for residential uses are also considered inappropriate for recreational development that would attract preschool children (e.g., picnic areas or playgrounds).

- Regarding potential recreational activities, the majority of hillsides outside of the immediate vicinity of the Smelter Complex are suitable for unrestricted activities under current conditions. The entire Smelterville Flats, Mine Operations Area, abandoned Smelter Complex, the adjacent hillsides, and gulches are currently unsuitable for recreational activities for either children or adults. The most significant risks are associated with potential sub-chronic lead poisoning due to contact with contaminated soils, dusts, and sediments. Chronic non-carcinogenic disease could also result from continued consumption of surface waters during recreational activities.

- With respect to potential occupational uses of the Non-populated Areas, women of reproductive age that may become pregnant are the population of concern. Common occupational activities by pregnant women could more than double prenatal exposures to lead in all areas except the general hillsides. Especially severe exposures could occur on a short-term basis within the abandoned complex, the CIA area, or the Mine Operation Areas. Within these latter areas, workers are potentially at-risk for both carcinogenic and chronic non-carcinogenic disease under a 35-year occupational scenario.

Table 6-1

Summary of Baseline Carcinogenic Risk Estimates[a]
Route-Specific Risk

LOCATION	CONTAMINANT	INHALATION	YARD SOIL INGESTION	HOUSE DUST INGESTION	OTHER SOIL/DUST INGESTION	DRINKING WATER	MARKET BASKET FOOD	TOTAL ORAL	TOTAL ALL ROUTES
Smelterville	Arsenic	7.8×10^{-5}	2.8×10^{-5}	5.7×10^{-5}	1.2×10^{-5}	8.1×10^{-5}	8.6×10^{-4}	1.0×10^{-3}	1.1×10^{-3}
	Cadmium	5.8×10^{-5}							
	Total	1.4×10^{-4}	2.8×10^{-5}	5.7×10^{-5}	1.2×10^{-5}	8.1×10^{-5}	8.6×10^{-4}	1.0×10^{-3}	1.1×10^{-3}
Kellogg/ Wardner/ Page	Arsenic	3.8×10^{-5}	2.2×10^{-5}	5.8×10^{-5}	9.5×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	1.0×10^{-3}	1.1×10^{-3}
	Cadmium	1.8×10^{-5}							
	Total	5.6×10^{-5}	2.2×10^{-5}	5.8×10^{-5}	9.5×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	1.0×10^{-3}	1.1×10^{-3}
Pinehurst	Arsenic	4.7×10^{-6}	1.3×10^{-5}	7.2×10^{-6}	5.4×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	9.6×10^{-4}	9.8×10^{-4}
	Cadmium	1.4×10^{-5}							
	Total	1.9×10^{-5}	1.3×10^{-5}	7.2×10^{-6}	5.4×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	9.6×10^{-4}	9.8×10^{-4}
Background	Arsenic	4.7×10^{-6}	5.1×10^{-6}	2.4×10^{-5}	2.2×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	9.6×10^{-4}	9.8×10^{-4}
	Cadmium	5.7×10^{-6}							
	Total	1.0×10^{-5}	5.1×10^{-6}	2.4×10^{-5}	2.2×10^{-6}	8.1×10^{-5}	8.6×10^{-4}	9.6×10^{-4}	9.8×10^{-4}

(a) Contaminants and media for which risk is not estimated is due to lack of an appropriate CPF and/or media concentrations from which intakes can be estimated. CPFs are available only for arsenic (oral and inhalation) and cadmium (inhalation only). 1990 value CPFs utilized.

(b) Background carcinogenic risk associated with market basket foods was assessed using arsenic oral Cancer Potency Factor (CPF) found in 1989 U.S. EPA-YEAST Tables and contemporaneous FDA estimates of arsenic in food. A significant portion of arsenic intakes from the market basket is associated with seafood consumption, may be rapidly absorbed and excreted, and may not pose the same level of risk as inorganic arsenic ingestion.

Table 6-2

Summary of Exposure Routes, Scenarios and Potentially High Risk Activities that Could Result in Unacceptable Chronic Risk to Noncarcinogenic Disease (Combined Populated and Non-populated Areas)

Skin Lesions		
Due to arsenic exposures:	Smelterville Residential	baseline plus ground water consumption, HI ≥ 1.1
	Smelterville Flats CIA, Industrial Complex	baseline plus ground water consumption, HI ≥ 1.92[a] baseline plus ground water consumption, HI ≥ 2.58[b]
	Mine/Mill Area	baseline plus occupational dust, HI ≥ 1.0
	Lead Smelter	baseline plus occupational dust, HI ≥ 1.3
	Magnet Gulch	baseline plus occupational dust, HI ≥ 1.2
Anemia		
Due to zinc (and lead*) exposures:	Smelterville Residential	baseline plus ground water consumption, HI ≥ 2.1
	Kellogg/ Wardner/Page Residential	baseline plus ground water consumption, HI ≥ 1.5
	Smelterville Flats, CIA, Mine/Mill, Industrial	baseline plus ground water consumption, HI ≥ 1.56[a] baseline plus ground water consumption, HI ≥ 1.1[b]
Gastrointestinal irritation		
Due to antimony and copper exposures:	Lead Smelter Residential Areas	baseline plus occupational dust, HI ≥ 1.2 none
	Smelterville Flats, CIA, Industrial Complex	baseline plus ground water consumption, HI ≥ 4.31[a] baseline plus ground water consumption, HI ≥ 1.18[b]
Renal dysfunction		
Due to cadmium and mercury (and lead*) exposures:	Both Smelterville and Kellogg/ Wardner/Page Residential	baseline plus local garden produce consumption, HI ≥ 1.3 - 1.4 baseline plus ground water consumption, HI ≥ 3.5 - 19
	Smelterville Flats, CIA, Mine/Mill, Industrial	baseline plus ground water consumption, HI ≥ 3.0 - 131[a], HI ≥ 1.8 - 35.8[b]
	Smelterville Residential	baseline plus "pica-type" behavior, HI ≥ 1.1 - 1.3
	CIA Area	baseline plus surface water, HI ≥ 2.4
	Lead Smelter	baseline plus surface water, HI ≥ 3.6
	Acid Tank Farm	baseline plus occupational dusts, HI ≥ 1.1
	Magnet Gulch	baseline plus occupational dusts, HI ≥ 1.1
	Government Gulch	baseline plus occupational dusts, HI ≥ 1.1
	Zinc Plant	baseline plus occupational dusts, HI ≥ 1.0
Reproductive Problems		
Due to contact with manganese	Smelterville Flats, CIA, Industrial Complex	baseline plus ground water, HI ≥ 1.0 - 9.7[a] baseline plus ground water, HI ≥ 1.5 - 2.6[b]

[a] Potential residential exposure
[b] Incremental occupational exposure

NOTE: "Pica-type" behavior is associated with extreme soil and dust ingestion rates exhibited by some children of ages 2 through 6 years.

* While an RfD is not available for lead, extreme lead exposures can contribute to anemia and renal disease.

Table 6-3

Non-populated Areas Geographic Units
That Exceed the Residential Areas Soil Lead Action Level of 1000 ppm

LOCATION	SOIL LEAD CONCENTRATIONS (ppm)	
	mean	extreme
HILLSIDES	1,015	2,360
CIA--TAILINGS POND	1,675	13,400
PHOSPHATE PLANT	1,752	14,000
LANDFILL	2,104	2,730
MINE DUMPS	2,977	16,300
ACID TANK FARM	3,299	73,200
LOWER GOVT. GULCH	3,641	6,930
DEADWOOD GULCH & SLOPES	4,201	37,400
PAGE POND SWAMPS	4,302	6,000
SMELTER HEIGHTS	6,084	104,000
CIA-GYPSUM POND	6,112	85,210
S.FLATS NORTHEAST	8,285	15,900
S.FLATS N.FLOODPLAIN	10,672	17,700
CIA--SLAG PILE	10,855	29,100
ZINC PLANT	17,605	132,000
M/M-BOULEVARD	18,692	79,500
S. FLATS IND.CORRIDOR	18,867	29,000
UPPER GOVT. GULCH	24,629	133,000
M/M-CEN. TREAT. PLANT	36,369	48,700
M/M ACTIVE MINE	36,956	242,000
MAGNET GULCH	48,796	143,000
LEAD SMELTER	48,796	178,000

Source: RI Data

- Acute exposures representing an immediate threat to life and health could result from short-term exposures in the Smelter Complex or Mine/Mill Areas. While no specific criteria or thresholds have been identified in the two areas for short-term exposures it is nonetheless prudent to avoid even minimal contact with the high contaminant concentrations exhibited in these locations. In these areas, exceedance of 10,000 mg/kg concentration levels (10 times the Populated areas cleanup level) for lead are common. Antimony, arsenic, cadmium, and mercury are also highly elevated. Excessive risk of acute toxic effects could also result from heavy metals and arsenic exposure in the CIA Area, the Smelterville Flats, and Hillsides adjacent to the industrial complex. (SAIC, 1992).

6.2 ENVIRONMENTAL RISKS

Soil, sediment, surface water, and ground water within the Site exhibit elevated levels of antimony, arsenic, cadmium, copper, lead, manganese, mercury, silver, and zinc. Lack of vegetative cover over much of the Site has resulted in the loss of wildlife habitat and increased soil erosion. Concentrations of metals over large areas of the Site adversely impact both aquatic and terrestrial biota.

Current levels of cadmium, lead, and zinc in surface water adversely affect resident populations of benthic organisms, fish, and aquatic plant species. Acute and chronic ambient water quality criteria for these metals are substantially exceeded in the SFCDR. Low flow contaminant loading information in the RI indicates that approximately 700 lbs/day of zinc, eight lbs/day of lead, and four lbs/day of cadmium enter the SFCDR from within the Site.

Average cadmium and zinc concentrations in the SFCDR within the Site exceed acute water quality criteria by approximately three and fifteen times, respectively. In addition, cadmium and zinc upstream of the site (SF-2) exceed acute aquatic life criteria by approximately four and twenty-one times, respectively. In the Coeur d'Alene River at Cataldo, approximately ten miles downstream from the Site, cadmium and zinc exceed acute criteria values by about two and eleven times, respectively. Contamination upstream of the Site contributes to excessive metal loadings found in the river and are combined with metal loadings within the Site via surface water runoff and ground water contamination. An environmentally significant threat exists to aquatic populations and trophic diversity in the Coeur d'Alene River as a result of the South Fork water quality.

Although tolerant species of fish and benthic organisms appear to be re-establishing within the Site, toxicity tests on rainbow trout and water fleas conducted during the RI show that lethal conditions for less tolerant species currently exist in the SFCDR. Persistent contamination in the SFCDR and natural processes such as erosion and flooding continue to alter water and sediment quality upstream, within the Site, and in the lower reaches of the Coeur d'Alene River.

Average concentrations of antimony, arsenic, cadmium, copper, lead, mercury, silver, and zinc in hillside soils exceed reference (background) concentrations by as much as 50 times for lead, 25 times for cadmium, and 12 times for zinc. These elevated levels are also a source of contamination in the surface water, ground water, and sediments and are potentially toxic to terrestrial biota. The following Table 6-4 shows soil toxicity reference concentrations that may induce toxicological effects on plants, soil invertebrates, and small mammals; it also provides the approximate acreage that may exceed the reference levels.

Estimated intake levels for mice, deer, and waterfowl compared with toxicological reference values indicate that current arsenic and zinc levels in localized areas are likely to cause adverse effects in small mammals. Lead and silver levels are also expected to have sublethal effects on small mammals, while antimony, copper, and manganese concentrations in soil may have sublethal effects on less tolerant individuals. Figure 6-1 shows major Site areas where soil metal concentrations exceed projected toxic levels. Approximately 850 acres in the vicinity of the Lead and Zinc Smelters and 450 acres in Smelterville Flats have soil concentrations capable of inducing adverse toxicological effects on plants, soil invertebrates, and small mammals. Other localized areas of the Site have contaminant levels that could produce long term sublethal effects on such organisms.

Waterfowl are particularly at risk of toxic effects from ingestion of lead in soil and plants; however, waterfowl exposure within the Site is limited by the general lack of attractive habitat. The assessment of lead hazards to waterfowl in the Coeur d'Alene River Basin are complicated by the ingestion of lead shot. Impacts include documented periodic acute poisoning, as well as uncertain chronic effects such as enhanced susceptibility to disease, predation, and reproductive impairment. Tissue analyses detected elevated lead levels in all samples analyzed. Concentrations of metals in soil and sediments in some localized areas of the basin are similar to those found within the Bunker Hill Site; however, major differences exist in their physical characteristics. Habitat differences between the Site and basin also obscure comparisons of similar risks.

Impaired trophic communities and structural habitat exist throughout the Site and are especially evident by the barren and sparsely vegetated areas on the hillsides and flats. Elevated metal concentrations continue to disrupt the interaction and interdependence between soil, plants, and terrestrial fauna, which are integral components in soil stability, wildlife habitat, food chain pathways, and nutrient cycling.

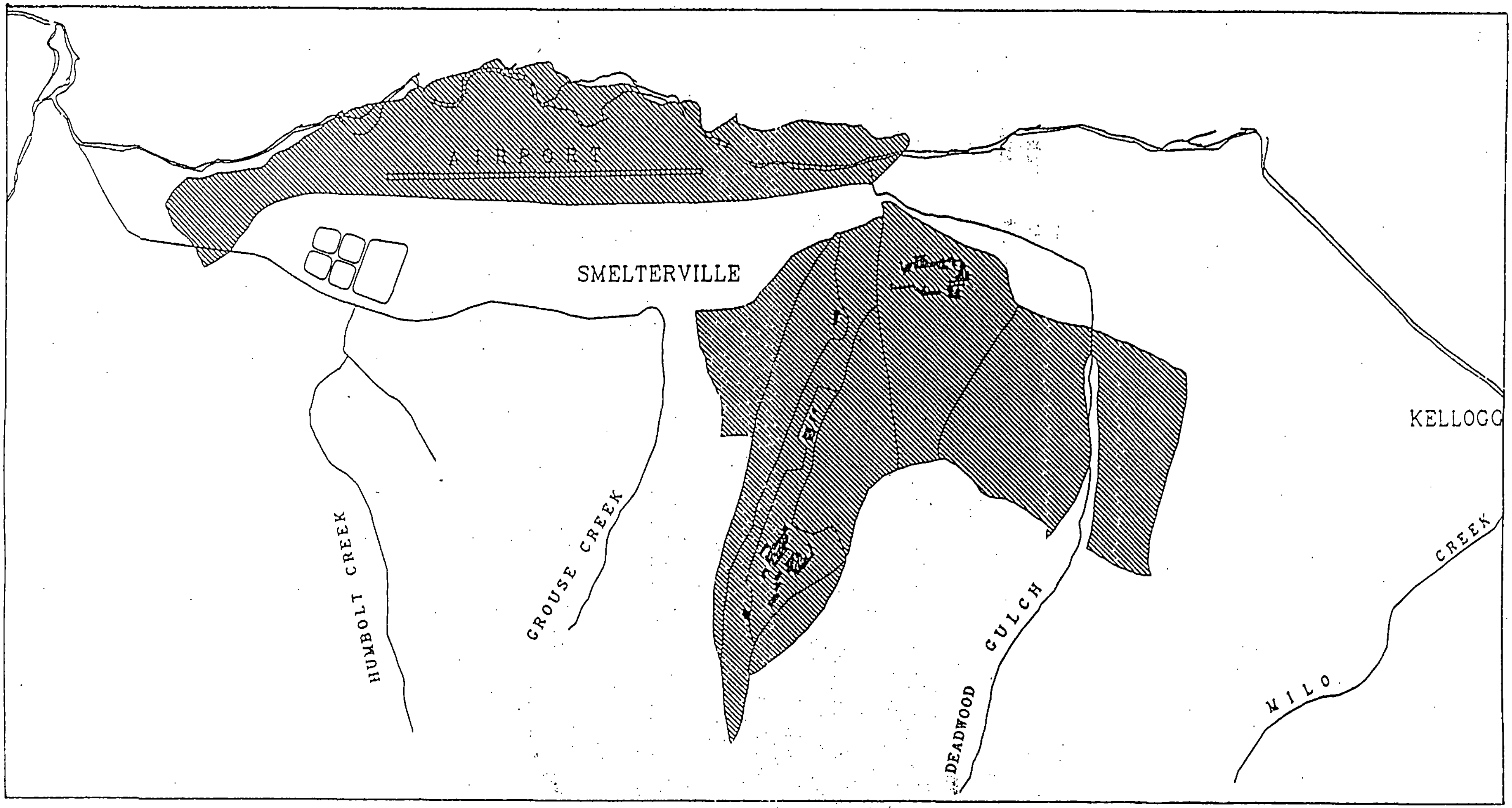
Contamination of localized areas alter species composition and occurrence. Soil structure is deteriorated and the integrity of the organic matter and litter layers are severely reduced. The maintenance of biogeochemical processes and cycles are also altered. Water retention and erosion control by major water sheds are dysfunctional and can not moderate environmental extremes.

Table 6-4

Soil Toxicity Reference Concentrations
That May Induce Toxicological Effects on
Plants, Soil Invertebrates, and Small Mammals

Contaminants	Soil Toxicity Reference Concentrations[a] (mg/kg)		Approximate Acreage[b] Exceeding Minimum Reference Concentration
	Plants and Soil Invertebrates	Small Mammals	
Arsenic	40	78	2500
Cadmium	20	1875	1000
Copper	60	1350	1800
Lead	1000	2250	7800
Mercury	5	NA	400
Silver	8	17	800
Zinc	500	1260	2500

a As described in the Ecological Risk Assessment
b Includes acreage from hillsides, smelter complex area, and Smelterville Flats (north of highway)



Note: Other localized areas not shown may induce toxic effects to either plants or animals.

MAJOR AREAS CONTAINING METAL CONCENTRATIONS THAT MAY INDUCE TOXICOLOGICAL EFFECTS ON PLANTS, SOIL, INVERTEBRATES, AND SMALL MAMMALS

FIGURE 6.1

Terrestrial and aquatic communities, however, have exhibited some natural succession, and several areas have demonstrated signs of recovery. An evaluation of ecosystem indicators at the Site show a capacity for adjustments and adaptation.

Remedial actions at the Site can have a significant beneficial impact on the re-establishment of native terrestrial and aquatic communities within the Site and are expected to contribute to improvements to water quality in lower reaches of the Coeur d'Alene River. Establishment of vegetative cover in areas impacted by past mining, milling, and smelting operations; control of wind and water erosion; and minimization of metals loading to surface and ground water will enhance recovery of the local environment.

However remediation of the Site will not restore the Coeur d'Alene Basin, as a whole, to a condition that existed prior to the advent of mining in the region. Remediation of the Bunker Hill Site is only one component of what will be a basin wide approach to addressing impacts from decades of mining, forestry, agriculture, and development in the Coeur d'Alene Basin.

Recently, federal, state, tribal, and local interests have held discussions to build upon past efforts in understanding basin environmental problems in order to develop a Coeur d'Alene Basin Restoration Project. Successful efforts by these groups, coupled with remedial actions at the Site, have the potential to enhance recovery of many of the environmental features of the Coeur d'Alene Basin that have been compromised over the past 100 years.

7 DETAILED DESCRIPTION OF ALTERNATIVES

This proposed cleanup action involves the Non-populated Areas of the Site and those areas within the Populated areas not covered under the Residential Soils ROD. These are areas that are typically used for many different activities and purposes. While it is important that the cleanup actions block or remove the routes by which people and organisms come in contact with contaminants, it is also important that the remedial actions allow for continued growth of the community.

Remedial actions selected must eliminate, or reduce to acceptable conditions, the routes by which people and environmental receptors come in contact with or are affected by contaminants in soil, dust, and water. It is also important that the remedial action not unduly interfere with resident or community activities during and after the remediation process. The remedial alternatives were developed with these factors in mind and with consideration given to present and anticipated land use activities. Institutional controls that assure the integrity of remedial actions selected for the Site are an important component of all alternatives presented. Continued development of the area will be possible if undertaken consistent with remedial actions specified in this ROD and managed through the Institutional Control Program (ICP). Institutional controls were also an important component of the Residential Soils ROD, (August 1991). Previous public comment on the Residential Soils ROD indicated that the community would only support an ICP if there were no costs to local citizens or governments.

To achieve an acceptable level of protectiveness, the remedial alternatives were designed to attain site wide and sub-area specific Remedial Action Objectives (RAOs). RAOs are general cleanup objectives that are established early in the FS process to guide the development of cleanup alternatives. The selected RAOs reflect consideration of risk management principles and available information identifying contaminants, media of concern and potential exposure pathways. They represent preliminary judgements regarding acceptable exposures to site contaminants, from a variety of routes, that are adequately protective of human health and the environment.

Biological monitoring is an important component of all alternatives with respect to evaluating potential impacts on environmental receptors. While each alternative includes extensive efforts to contain or manage contaminants posing an environmental threat, certain areas of the Site, particularly hillsides adjacent to the smelter complex, may have a potential to impact sensitive species of plants and animals after implementation of remedial actions. No specific soil cleanup goals (ARARs) have been established to evaluate risk to environmental receptors, however, the ecological risk assessment has developed soil toxicity reference concentrations which are intended to serve as an indicator of potential impact.

While residual contamination may pose a potential threat to environmental receptors at the Site the FS determined that remediation of all hillside areas to levels below soil toxicity reference contamination was infeasible. Habitat establishment was, however, determined to be both feasible, and desirable, and is a component of all alternatives presented in the FS. As habitat is established, and environmental receptors are exposed to residual soil contamination, monitoring will be conducted to evaluate actual impacts to resident populations.

RAOs are expected to be attained through achievement of remedial action specific performance standards. The reliance on performance standards for individual remedial actions is intended to provide a realistic measure of success for the specific actions proposed. They have been developed to achieve overall cleanup objectives for the Site. Performance standards for the selected remedial actions are discussed in greater detail in Section 9.2. The performance attributed to other alternatives is discussed in detail in the FS and supporting Technical Memoranda.

General response actions (GRAs) and technologies were selected and evaluated based on effectiveness, implementability, and cost in reaching their respective RAOs. Alternatives, or combinations of remedial technologies, were then developed for each media and subarea. Finally, comprehensive site wide alternatives were developed to address the site wide RAOs for the four principal site media: soil/source materials, ground water, surface water, and air. As a result, the FS Report proposed four site wide remediation alternatives. Except for the No Action Alternative which served as a baseline comparison alternative only, all of the site wide alternatives are able to satisfy, to varying degrees, the nine evaluation criteria, (discussed in detail in Section 8), required by the NCP to be used when comparing various remediation alternatives.

The proposed alternatives have been described in the Proposed Plan as follows:

Alternative 1:	No-Action
Alternative 2:	Source and Institutional Controls
Alternative 3:	Source Controls and Treatment
Alternative 4:	Removal, Source Controls and Treatment

7.1 ALTERNATIVE 1
NO ACTION

Alternative 1 is the No Action Alternative required for evaluation under the NCP. This alternative incorporates those removal actions and Orders already implemented or underway which were summarized under "Site History". The determinations made in the Residential Soils ROD have also been considered in the development of Site-wide remedial alternatives presented here. As a result of these response actions, transport of contaminants via surface water and air from various onsite sources have been reduced. Additionally, human exposures to soil/source materials have also been reduced in the Hillside, Smelterville Flats, CIA, ROW, and Smelter Complex subareas. Alternative 1 serves as a baseline for comparison and evaluation of the other alternatives.

7.2 ALTERNATIVE 2
SOURCE AND INSTITUTIONAL CONTROLS

Alternative 2, the Source Containment and Institutional Controls Alternative, was developed as a potentially effective solution to address Site-wide RACs, primarily through the use of containment (barrier) technologies. It is comprised of components that include containment/stabilization, drainage and erosion controls, and institutional controls. As compared to the No Action Alternative, Alternative 2 would further reduce the mobilization of contaminants via surface water and air and prevent human contact. Active ground water controls are not included in this alternative; however, significant ground water and surface water improvements are expected over time due to source containment aspects of this alternative and the considerable efforts being undertaken to establish vegetation on over 3,200 acres of the Site which are currently eroding at excessive rates.

7.3 ALTERNATIVE 3
SOURCE CONTROLS AND TREATMENT

Alternative 3, the Source Controls and Treatment Alternative, addresses the Site wide RAOs by utilizing a combination of: source containment (in-place caps); selective source removal; drainage and erosion controls; innovative treatment of ground water and surface water; treatment of selected source materials; and, institutional controls. Alternative 3 was developed to utilize a combination of innovative and conventional engineering controls and treatment options with respect to ground water and surface water in particular. This alternative will also use cement-based stabilization to treat all Principal Threat materials (defined in Section 9.2.5) before they are contained when they are not recycled or reprocessed. This alternative would reduce and/or eliminate the mobilization of soil/source materials, surface water, ground water, and air-borne dusts.

7.4 ALTERNATIVE 4
REMOVAL, SOURCE CONTROLS, AND TREATMENT

Alternative 4 is the Source Controls and Removal Alternative which relies upon: source removals with disposal in engineered repositories; treatment of ground water and surface water; conventional engineering controls; and institutional controls. This alternative is distinguished from Alternative 3 through its reliance on source removal and conventional water treatment technologies instead of innovative treatment technologies. This alternative would significantly decrease the impacts of soil/source material contaminants and further reduce surface water, ground water, and air-borne contaminant transport.

Each of the alternatives (except for the No Action Alternative) has been developed to specifically address human health and environmental concerns and has identified specific remedial actions for soils/source materials, ground water, surface water, and air associated with each of the subareas. Site wide subarea remedial action alternatives are presented in Table 7-1. These tables outline the remedial action components designed to address media-specific and subarea contamination individually. They also delineate the combinations of actions comprising each specific site wide remedial alternative proposed. Detailed descriptions of each subarea and site wide remedial action alternative are provided in the Bunker Hill Superfund Site Final Feasibility Study Report (May 1, 1992) and associated Technical Memoranda. These documents are all available as part of the Administrative Record.

TABLE 7-1

Summary of Site Wide Remedial Action Alternatives by Subarea

Subarea	Remedial Actions	Alternatives 1	2	3	4
Hillsides	Current actions in hillsides including contouring/terracing on barren areas and revegetation of areas with less than 50% cover.	x	x	x	x
	Erosion control structures and surface water treatment for sediment reduction in detention ponds in Deadwood, Magnet, and Government Gulches.	x	x	x	x
	Institutional Controls.		x	x	x
	Spot re-vegetation of areas with less than 50 percent cover within 50-85 percent cover class.			x	x
	Surface armor or soil cover on selected mine waste rock dumps.	x	x	x	x
	Channelize upper Milo Creek.		x	x	x
	Enforce existing controls on access.		x	x	x
	Maintain existing fencing.		x	x	x
Smelterville Flats	Rock/vegetation barriers on truck stop and RV park.	x	x	x	x
	Revegetate as practicable; temporary dust control on unvegetated areas.	x	x	x	x
	Institutional Controls.		x	x	x
	Soil or rock barriers on exposed contaminated soils and tailings that cannot be revegetated.		x	x	
	Remove selected jig tailings for South Fork Coeur d'Alene River channelization.		x		
	Remove selected jig tailings as necessary for wetland and floodway construction.			x	
	Construct ground water wetland upstream of Pinehurst Narrows (34 acres).			x	
	Construct collected water wetland treatment system (74 acres).			x	
	Construct floodway for South Fork Coeur d'Alene River.			x	
	Collect upper zone ground water at western Smelterville Flats for wetland treatment.			x	
	Remove all accessible jig tailings for onsite disposal in CIA.				x
	Collect upper zone ground water at western Smelterville Flats for conventional treatment.				x

TABLE 7-1

Summary of Site Wide Remedial Action Alternatives by Subarea

Subarea	Remedial Actions	Alternatives 1	2	3	4
Central Impoundment Area	Temporary dust control measures.	x	x	x	x
	Institutional Controls.		x	x	x
	Institutional controls to restrict access (fencing).	x	x		
	Regrade, improve drainage and vegetate CIA dikes.		x		
	Seal CIA tailings using soil or chemical agents.		x		
	Permanent dust control through containment, soil/rock barriers and revegetation.		x		
	Rock and/or soil barrier on A-4 Gypsum Pond.			x	
	Collection of upper zone ground water in CIA seep area for wetland treatment.			x	
	Close CIA, soil/clay cap, and revegetate after removal of Smelter accumulation materials from CIA for onsite disposal and emplacement of jig tailings from Smelterville Flats.			x	x
	Collection of upper zone ground water in CIA seep area for conventional treatment.				x
Page Pond	Temporary dust control.	x	x	x	x
	Institutional Controls.		x	x	x
	Improve drainage and vegetate Page Pond dikes.		x		
	Permanent dust control measures (soil/rock) on Page Pond.		x		
	Rock or soil barriers on exposed jig tailings in West Page Swamp.		x		
	Channelize lower Humboldt and Grouse Creeks.		x	x	x
	Move exposed jig tailings (up to 18 acres) in West Page Swamp to Page Pond.			x	x
	Regrade, soil cover and revegetate Page Pond tailings impoundment and dikes after emplacement of West Swamp jig tailings.			x	x
	Enhance existing wetlands in West Page Swamp using hydraulic controls.			x	x

TABLE 7-1

Summary of Site Wide Remedial Action Alternatives by Subarea

Subarea	Remedial Actions	Alternatives 1	2	3	4
Smelter Complex	Fire controls and annual structural inspection.	x			
	Temporary dust control on material accumulation sites.	x	x	x	x
	Remove PCB transformers and PCB-contaminated soils.	x	x	x	x
	Repair or remove asbestos materials.	x	x	x	x
	Channelize and line Government Creek.		x	x	x
	Institutional Controls.		x	x	x
	Move material accumulations and contaminated soils to engineered repository.		x		x
	Demolish Lead Smelter and Zinc Plant structures in place and contain with soil/clay caps.		x	x	
	Relocate Boneyard materials under Smelter Cap.		x	x	
	Soil/clay cap on landfill.		x	x	
	Reprocessing of principal threat and other recyclable materials to minimize the volume of materials which would be capped.			x	
	Cement-based stabilization/fixation of the remaining principal threat materials, with disposal of treated materials under the Lead Smelter Cap.			x	
	Place cut-off wall in upper Government Gulch to divert clean water away from contaminated areas; place cutoff wall in lower Government Gulch to collect ground water for treatment in the collected water wetland.			x	
	Revegetate disturbed areas.		x	x	x
	Relocate A-1 Gypsum Pond to CIA.			x	x
	Relocate A-4 Gypsum Pond to CIA.				x
	Place demolition debris from Smelter Complex buildings and structures, soils from under the structures, Boneyard materials, and landfill materials in an expanded engineered repository.				x
	Place cutoff wall in lower Government Gulch to collect ground water for conventional treatment.				x

TABLE 7-1

Summary of Site Wide Remedial Action Alternatives by Subarea

Subarea	Remedial Actions	Alternatives 1	2	3	4
Mine Operations Area	Remove PCB transformers and PCB-contaminated soils.	x	x	x	x
	Repair or remove asbestos materials.	x	x	x	x
	Maintain fire controls and inspect structures annually.	x	x	x	x
	Institutional Controls.		x	x	x
	Move material accumulations and source materials to engineered repository.		x		x
	Treat mine water, if discharging, in a CTP.		x		x
	Reprocess or treat principal threat material accumulations when appropriate and relocate remaining materials (such as those in the Boulevard Area) under the Smelter cap.			x	
	Treat mine water, if discharging, in collected water wetland following conventional pretreatment.			x	
	Clean buildings.			x	x
	Channelize and line Bunker Creek.			x	x
	Treat Bunker Creek in collected water wetland			x	
	Maintain storm-drainage system and close mill settling pond.			x	x
	Install barriers consistent with land-use in remaining areas.		x	x	x
	Treat mine water, if discharging, in an upgraded CTP or new conventional treatment plant.				x
Rights-of-Way (ROWs) within Non-populated Areas	Temporary dust control on railroad ROWs and gravel roads.	x	x	x	x
	Enforce existing controls on access.	x	x	x	x
	Maintain existing fencing.	x	x	x	x
	Institutional Controls.		x	x	x
	Permanent dust control through containment, "hot spot" removal, soil/rock barriers and revegetation.		x	x	x
Rights-of-Way (ROW) within Populated Areas	Temporary dust control on railroad ROWs, gravel roads, and undeveloped property in residential areas.	x	x	x	x
	Enforce existing controls on access.	x	x	x	x
	Maintain existing fencing.	x	x	x	x
	Institutional Controls.		x	x	x
	Permanent dust control through containment, soil/rock barriers and revegetation.		x	x	x
	During remedial construction, temporary surface sealer application on roads.			x	x
	Remove exposed source materials and tailings on ROWs.				x

TABLE 7-1

Summary of Site Wide Remedial Action Alternatives by Subarea

Subarea	Remedial Actions	Alternatives 1	2	3	4
Commercial Buildings and Lots	Temporary dust control on commercial lots and undeveloped property in residential areas.	x	x	x	x
	Institutional Controls.		x	x	x
	Revegetate or cover exposed source materials and tailings on commercial lots.		x	x	x
	Educational programs to encourage interior cleaning in commercial buildings.		x	x	x
	Institutional controls on replacement of carpets, floors, and attic insulation.		x	x	x
	Provide onsite disposal site for soils excavated during future construction.		x	x	x
	Plug existing wells and provide alternate water supplies.		x	x	x
	Institutional controls on future development (including measures mandated in the residential soils ROD), access restrictions, and future land use practices.		x	x	x
	Remove exposed source materials and tailings on commercial lots.				x
Residential Interiors	Continued blood lead monitoring.	x	x	x	x
	Provide HEPA vacuum cleaners for public use.	x	x	x	x
	Educational programs to encourage interior cleaning.	x	x	x	x
	Institutional controls/procedures for normal replacement of carpets, floors, and attic insulation.		x	x	x
	Plug existing wells and provide alternate water supplies.		x	x	x
	One time cleaning of residential interiors after completion of site wide remedial actions, if interior dust sampling program indicates that house dust lead concentrations exceed program objectives.			x	x
	Carpet removal and replacement after completion of site wide remedial actions.				x
Future Development in Non-populated Areas	Existing development requirements.	x			
	Institutional Controls.		x	x	x
	Remediation will occur to address current human health and environmental concerns.		x	x	x
	Remediation activities specific to conditions at future land-use locations will be implemented, as appropriate, as development occurs; the remediation activities will be consistent with in-place institutional controls and intended land use.		x	x	x

8 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of alternatives using each of the nine evaluation criteria, as required by the NCP, is presented in this section. These criteria are set forth in Table 8-1. This analysis has been undertaken in a two-tiered fashion. First, an individual assessment was made of each alternative's ability to meet each of nine evaluation criteria delineated in the NCP. Secondly, a comparative analysis was undertaken to determine the relative performance of the alternatives and to identify major trade-offs (i.e., the relative advantages and disadvantages) among them. The purpose of this analysis is to identify the advantages and disadvantages of each alternative relative to the other alternatives.

8.1 INDIVIDUAL ANALYSES

8.1.1 Alternative 1: No Action

The no action alternative serves as a baseline to evaluate all other alternatives. While it incorporates all previous and planned response actions taken at the Site, the No Action Alternative fails to fully address contaminant pathways on a site wide basis. ARARs and site wide RAOs established to ensure protectiveness of human health and the environment are not met. Therefore, the no action alternative fails to satisfy the regulatory threshold requirements of protection of human health and the environment, and compliance with ARARs. In addition, this alternative fails to utilize permanent and alternative treatment technologies, ranks poorly with regard to long-term effectiveness and permanence in reducing risk, fails to substantially reduce the toxicity, mobility, or volume of hazardous waste associated with the Site, and is not considered short-term effective. Because it provides a baseline for comparison, implementability and cost are not considered.

8.1.2 Alternative 2: Source and Institutional Controls

The combination of engineering, source, and institutional controls proposed under Alternative 2 achieves the threshold criteria of protectiveness of human health and the environment. It is expected that this alternative would meet ARARs and RAOs identified for soils and source materials as well as air. RAOs developed to protect environmental receptors will not be met in all areas of the Site in the near term; however, as discussed in the Ecological Risk Assessment, current wide spread habitat destruction limits actual exposure of environmental receptors to potentially toxic soil conditions. Seepage reduction and control at the CIA, Page Ponds, and the Smelter Complex sources are expected to promote significant improvements to Site wide ground water quality and to substantially achieve ground water RAOs pertaining to onsite sources over time. Also, loadings reductions to surface water expected under this alternative would provide significant water quality improvement in the SFCDR and would substantially achieve surface water RAOs pertaining to onsite sources. Offsite seeps and

TABLE 8-1 COMPARATIVE ANALYSIS OF ALTERNATIVES	
These are the evaluation criteria that are required by the NCP to use when comparing the various cleanup alternatives.	
1)	Overall protection of human health and the environment: Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
2)	Compliance with federal and state environmental standards: Addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of other federal and state environmental statutes and/or provide grounds for requesting a waiver.
3)	Long-term effectiveness and permanence: Refers to the magnitude of remaining risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.
4)	Reduction of toxicity, mobility, and volume: Addresses the anticipated performance of the treatment technologies that may be employed in a remedy in terms of eliminating or controlling risks posed by the toxicity, mobility, or volume of hazardous substances.
5)	Short-term effectiveness: Refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment during the construction and implementation period.
6)	Implementability: Addresses the technical and administrative feasibility of a remedy including the availability of materials and services needed to implement the chosen solution.
7)	Cost: Includes capital costs, operating and maintenance (O&M) costs (including Institutional Controls), and evaluates the cost-effectiveness of each alternative.
8)	State acceptance: Indicates whether the state concurs with, opposes, or has no comment on the preferred alternative.
9)	Community acceptance: Assessed following a review of public comments, both oral and written, received on the RI/FS and supporting technical memoranda documents.

loadings and the widespread existence of jig tailings onsite may inhibit immediate compliance with certain ground water ARARs in some areas of main valley aquifer. Ultimate attainment of Federal Water Quality Criteria (FWQC) in the SFCDR, and Maximum Contaminant Level (MCL) and Maximum Contaminant Level Goals (MCLGs) promulgated under the Safe Drinking Water Act (SDWA) in portions of the valley aquifer system, will depend on the implementation and effectiveness of offsite programs to reduce or control contaminant transport and on the ability of onsite remedies to meet performance standards over time. Separate offsite programs to restore the Coeur d'Alene River Basin are currently being formulated by a multi-disciplinary group of Federal, State, Tribal, and local governments in an effort to coordinate programs to restore water quality in the Basin to its maximum beneficial use.

A contingent waiver for chemical-specific ARARs within the main valley aquifer system will be granted only after technical impracticability has been demonstrated, consistent with the procedure outlined in Section 10 of this ROD. All alternatives will rely on institutional control of water use to be adequately protective of human health. Five year reviews will be relied upon to evaluate the effectiveness of the selected remedy and compliance with ARARs.

The overall long-term effectiveness of Alternative 2 is rated moderate based on the degree to which site wide RAOs are addressed, the degree to which the Principal Threats are reduced, the reduction of risks to humans, and the need to rely on long-term institutional controls to achieve protectiveness for contaminants remaining onsite. Because Alternative 2 does not propose treatment of Principal Threat materials, it does not meet the statutory preference for remedial actions that employ treatment technologies that significantly reduce the toxicity, mobility, or volume of hazardous waste. However, the removal and onsite containment of source materials contemplated under Alternative 2 would substantially decrease the magnitude of residual risk and provide long-term effectiveness by decreasing the volume of uncontrolled waste sources which can contribute to exposure pathways of concern. Capping and cover requirements contemplated under this alternative would also contribute to a reduction in mobility of contaminants of concern.

Alternative 2 is readily implementable and would not result in excessive risk to workers or the community, if properly implemented; therefore, it is considered short-term effective. Total capital costs are estimated to be $31.3 million, while O&M costs are estimated at $11.5 million. Total costs are significantly less than costs for Alternatives 3 and 4; but, the alternative does not provide comparable site wide improvements.

8.1.3 Alternative 3: Source Controls and Treatment

By combining containment, treatment, and institutional controls, Alternative 3 addresses all onsite pathways and is protective of human health and the environment onsite. In addition, it effectively contributes to improvements in downstream water quality. This alternative provides a high level of protectiveness, would minimize exposure pathways identified for soils, source material, and air, and would attain soil and air RAOs site wide for human health protection. RAOs developed to protect environmental receptors will not be met in all areas of the site in the near term; however, as discussed in the Ecological Risk Assessment, current wide-spread habitat destruction limits actual exposure of environmental receptors to potentially toxic soil conditions. As habitat onsite is re-established environmental receptors will be monitored to evaluate potential impacts. Actions specified in Alternative 3 are expected to have significant water quality benefits, limit direct exposure to the most contaminated soils onsite, and re-establish vegetative cover over exposed areas of the Site. Although FWQC in the SFCDR are not expected to be met in the near term, Alternative 3 adequately controls onsite sources to the river and substantially improves water quality and aquatic conditions both on and down gradient of the Site. Most Site-wide surface and ground water RAOs are expected to be met under this alternative. However, certain chemical-specific ground water ARARs in the main valley aquifer may not be achieved by onsite remedial actions.

As noted in Alternative 2, conditions for a contingent waiver for ground water are discussed in Section 10. Alternative 3 is expected to more rapidly achieve surface water and ground water ARARs onsite than Alternative 2, as it is expected to be more effective in controlling major contaminant sources. Action specific ARARs and ARARs dealing with air and soil/source materials will be met with implementation of this alternative. Relevant and appropriate requirements of RCRA Land Disposal Restrictions (LDRs) for cement-based stabilization of Principal Threat waste are expected to be attained. While LDRs for mineral processing wastes have not been promulgated (and therefore are not applicable), U.S. EPA has determined that it is appropriate to seek to achieve the percent reduction goals, and or extract concentration criteria, set forth in the LDRs for immobilization of inorganic compounds. Treatability tests for cement-based solidification of one of the major Principal Threat waste material accumulations onsite (the Copper Dross Flue Dust recently moved from Magnet Gulch to the Smelter Complex) indicates that attainment of percent reduction goals based upon TCLP protocols is likely. However, due to the varying solubilities of contaminants of concerns through a range of pH values U.S. EPA has determined that the acid leaching aspects of the TCLP test protocol are not appropriate for wastes consolidated in the Lead Smelter Closure, and has elected to design a stabilization mixture that will achieve LDR treatment goals at a pH reflective of actual onsite conditions. A rain water leach test has been determined to be more appropriate than an acid leach test.

The overall long-term effectiveness of Alternative 3 is expected to be high based on the degree to which it addresses site wide RAOs and the reliability and permanence of the prescribed controls. Alternative 3 removes, controls, and/or treats significant contaminant sources and effectively addresses site wide RAOs. The toxicity, volume, and mobility of source materials available for transport is effectively reduced. Because Alternative 3 proposes treatment of Principal Threats in soils and source materials, and treats ground and surface waters, it satisfies the statutory preference for treatment of hazardous wastes. Short-term effectiveness is mitigated by moderate, but manageable, human health and environmental risks associated with contaminant removal, transport, and onsite disposal.

Alternative 3 relies primarily on standard technologies which are readily implementable. The constructed wetland system may be considered innovative at this scale of application. However, it is expected to perform effectively with adequate design and management. Management of metals in the wetlands substrate (lower soils) may be required in the future; proper design and O&M of the treatment system should mitigate potential problems. Alternative 3 addresses human health and environmental concerns without significant threats to workers or the community and is considered short-term effective. Total capital costs are estimated at $56.6 million; and, O&M costs are estimated at $11.1 million. Alternative 3 provides considerably more improvements in site conditions than Alternative 2 for the increased cost.

8.1.4 Alternative 4: Removal, Source Controls, and Treatment

Alternative 4 addresses all pathways and is protective of human health and the environment. Site wide RAOs and ARARs for soils/source materials and air would be met for human health protection. RAOs developed to protect environmental receptors will not be met in all areas of the Site in the near term; however, as discussed in the Ecological Risk Assessment, current wide spread habitat destruction limits actual exposure of environmental receptors to potentially toxic soil conditions. Although ground water ARARs in the valley aquifer system and FWQC in the SFCDR are not expected to be met in the near term, Alternative 4 adequately controls these pathways onsite and would substantially improve water quality and aquatic conditions both onsite and down gradient of the Site, thus providing the largest practicable improvement in water quality and aquatic conditions of the four alternatives. It relies to a moderate degree on institutional controls to eliminate or reduce ground water and surface water exposures and to ensure the long-term reliability and effectiveness of other treatment and source control measures.

Most Site wide ground water and surface water RAOs are expected to be met under this alternative. However, as was noted in Alternatives 2 and 3 specific conditions for a contingent ARAR waiver in the main valley aquifer are outlined in Section 10. Alternative 4 is expected to be more successful in achieving ARARS onsite than Alternative 2, as it is more effective in controlling sources of ground water and surface water contamination. Action specific ARARs and ARARs for air, soil/source materials will be achieved.

The overall long-term effectiveness of this alternative is expected to be high based on the degree to which it addresses Site-wide RAOs and on the permanence and reliability of the prescribed controls. However, this effectiveness is tempered by the generation of potentially hazardous water treatment sludges over an indefinite time period. RAOs would be addressed and Principal Threats in soil and source material reduced through reliance on removal, containment and conventional water treatment. Loading reductions to ground water, surface water, and air would also be realized. Alternative 4 would significantly reduce the mobility of contaminants across the Site; however, only proposed water treatment remedial actions result in a reduction of volume or toxicity of contaminants.

Due to its reliance on extensive removal actions, Alternative 4 presents a higher level of potential human health and environmental risks and thereby negatively influences short-term effectiveness. These risks can be minimized by appropriate controls, but would require more intensive management compared to other alternatives.

Implementability of this alternative is considered readily feasible based on its utilization of standard technologies. However, implementability concerns do exist because of the large scale removal to be undertaken. Total capital costs are estimated at $90.2 million, while O&M costs are estimated at $87.9 million.

8.2 COMPARATIVE ANALYSIS

The subsequent sections summarize a comparative analysis of each of the nine evaluation criteria (Table 8-1) to determine the relative performance of the alternatives and identify major trade-offs.

8.2.1 Protection of Human Health and Environment

Alternatives 3 and 4 provide superior site wide protection relative to Alternative 2, which provides a relatively large increase in protectiveness over Alternative 1. Specifically, Alternative 2, 3, and 4 would all be protective with regard to soil, source, and air pathways. Alternative 2, however, provides adequate, but comparatively less, protection and improvement of ground and surface water pathways than Alternatives 3 and 4 as it relies more heavily on institutional controls to control potential exposure pathways. Alternatives 3 and 4 provide comparable net improvements and protectiveness site wide. All alternatives rely to various degrees on institutional controls to be protective of Human Health & the Environment both in the near and long term.

8.2.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2, 3, and 4 meet ARARs identified for soils, source materials, and air as well as action specific ARARs. Whether or not any of the alternatives would meet groundwater ARARs throughout the main valley aquifer is uncertain. Contamination attributable to dispersed and largely inaccessible jig tailings throughout the river valley may make attainment of certain of these ARARs impracticable. Section 10 includes a discussion of the basis for making the technically impracticability determination and waiving chemical-specific ARARs in areas of main valley aquifer system continuing to exceed ARARs after successful implementation of the remedy and contingent measures. Institutional controls will continue to protect against utilization of the aquifer until all Drinking Water Standards are met.

With respect to the attainment of FWQC in site surface water, these ARARs are expected to be achieved in onsite tributaries to the SFCDR upon the successful implementation of remedial actions specified in this ROD. The attainment of FWQC in the SFCDR has been determined to be beyond the scope of this ROD and is therefore not an ARAR for this action. Protection of the SFCDR from FWQC exceedances due to onsite sources, however, continues to be an objective of the remedial actions in this ROD. U.S. EPA is currently working with State, Tribal, and local government, as well as other federal agencies and local interest groups to develop and implement cleanup strategies for the Coeur d'Alene Basin which are expected to significantly improve water quality conditions both upstream and downstream of the Site.

Five year reviews will be relied upon to evaluate the effectiveness of the selected remedy and compliance with ARARs.

RCRA LDRs (40 CFR 268) are not applicable to the utilization of cement-based stabilization of Principal Threat wastes in Alternative 3, since LDRs for mineral processing wastes are not scheduled for promulgation until 1994. However, for the purposes of this action, percent reduction and/or extract concentration criteria goals of the LDRs will be considered to be relevant and appropriate for this treatment component of the remedial action. Treated Principal Threat waste would be consolidated within the Smelter Complex.

8.2.3 Long-Term Effectiveness

Alternatives 2, 3, and 4 are all effective and reliable remedies with respect to risks and conditions associated with onsite sources. However, Alternatives 3 and 4 provide additional improvements through treatment of surface and ground water. The treatment plant proposed in Alternative 4 would require more long-term maintenance than that anticipated under Alternative 3. This may affect effectiveness in the long-run.

In addition, Alternative 3 provides enhanced effectiveness relative to other Alternatives through treatment of Principal Threat wastes. The removal of all accessible jig tailings in Alternative 4 would increase the long-term effectiveness compared to Alternative 3. Alternative 3 utilizes institutional controls and the constructed wetland ground water system to mitigate the impacts of this contaminant source.

8.2.4 Reduction of Toxicity, Mobility, Volume, and Persistence through Treatment

Other than treatment actions for sediment reduction in tributary sedimentation basins, Alternative 2 does not incorporate treatment as a component of the remedy. It therefore compares poorly with respect to the statutory mandate for treatment. Alternatives 3 and 4 utilize treatment of ground and surface water to the same extent; and, both are considered adequate in utilization of appropriate levels of treatment in this regard. Additionally, Alternative 3 focuses on reprocessing/recycling or treatment of the Principal Threat materials from the Smelter Complex. Alternative 3 therefore goes further toward satisfying the statutory preference for reduction of toxicity.

8.2.5 Short-Term Effectiveness

Alternative 2 would be implemented in a relatively short time frame and would not pose large short-term risks. Alternatives 3 and 4 would take approximately twice as long to implement as Alternative 2. Due to the greater volumes of materials handled, some short-term risks to workers and the community may be associated with excavation under Alternative 3, while substantially greater potential risks, and time, would be associated with the more extensive excavation efforts under Alternative 4. The risk associated with Alternatives 3 and 4 can however, be managed with current construction and hazardous waste handling procedures. An example of these procedures would be dust control measures.

8.2.6 Implementability, Reliability, and Constructability

Alternatives 2, 3, and 4 are implementable using standard construction/remediation techniques. Long term monitoring efforts under Alternatives 2 and 3 may be greater than for Alternative 4. Alternative 4 would involve a sizable loss of developable land along the I-90 corridor due to extensive tailings excavation in Smelterville Flats and would necessitate obtaining onsite or near offsite landfill space to handle a continuing stream of treatment sludge generated by the water treatment plant.

8.2.7 Cost

A summary of estimated capital, O & M, and net present worth costs is provided in Table 8-2. Alternative 2 is significantly lower in capital and net present worth costs, but is also lower in overall long-term effectiveness. Although Alternative 3 is significantly lower in costs than Alternative 4, it provides comparable net protection and provides substantial improvements due to innovative surface and ground water treatment methods and the utilization of reprocessing/recycling technologies.

8.2.8 State Acceptance

IDHW and U.S. EPA have worked together throughout the development of the Bunker Hill Superfund project. The State of Idaho concurs with the selection of Alternative 3 as the remedial action for the Site.

8.2.9 Community Acceptance

The results of the public comment period and the discussion during the Proposed Plan Public Meeting indicate that the majority of the community supports the proposed alternative. The community expressed overwhelming desire to get the cleanup moving as soon as possible. See the Responsiveness Summary for additional details of community response.

8.2.10 Tribal Acceptance

The Coeur d'Alene Tribe has been participating in the Site activities since 1990. The Coeur d'Alene Tribe in their letter of August 1992, to U.S. EPA continues to express concern with the Proposed Plan for the Site. These concerns are addressed in the Responsiveness Summary Section.

Individual concerns about various aspects of the Proposed Plan are responded to in the attached Responsiveness Summary.

TABLE 8-2

SUMMARY OF COSTS *

Alternative Number	Capital Cost	O & M Cost	Total Cost	Present Worth Cost (5% discount rate)
1	$	$	$	$
2	$31,278,000	$11,547,000	$42,825,000	$31,549,000
3	$56,571,000	$11,096,000	$67,667,000	$52,035,000
4	$99,589,000	$87,929,000	$187,518,000	$120,291,000

* Costs do not include the cost of hillside work currently ongoing, the cost of additional planting in the 50 - 85% cover class on the hillside, and costs to remediate ROW, commercial buildings and lots, and residential interiors. However, costs do include demolition of the zinc plant and lead smelter tall stacks, which are not required by this ROD. The estimated costs for stack demolition are expected to be adequate to cover the majority of the costs not included in this table. The overall cost for the Remedial Action is consistent with the cost estimating guidelines in U.S. EPA RI/FS Guidance.

9 THE SELECTED REMEDY

9.1 INTRODUCTION

U.S. EPA and IDHW have selected Alternative 3 for cleanup of the Bunker Hill Superfund Site. This selection is based on the Administrative Record for the Site. These actions, coupled with actions required in the Residential Soils ROD and U.S. EPA directed response actions, constitute the Site wide remedial actions selected by the U.S. EPA and IDHW. The remedial actions are developed to address the subareas RAOs as well as media-specific concerns in that subarea.

9.2 REMEDIAL ACTIONS BY SUBAREAS

Remedial actions specified below were presented in Table 7-1; however, this section provides a more thorough discussion of the selected remedy and includes performance standards for remedial actions where appropriate. The discussion is presented in the following sections:

- Hillsides
- Smelterville Flats
- Central Impoundment Area (CIA)
- Page Pond
- Smelter Complex and Mine Operations Area
- Rights-of-Way (ROW)
- Commercial Buildings and Lots
- Residential Interiors
- Future Development in Non-populated Areas
- Constructed Wetland Treatment Systems
- Public Water Supply Considerations
- Soil Action Levels
- Operation and Maintenance

- Institutional Controls
- Monitoring
- General Remedial Design Considerations

9.2.1 Hillside Remedial Actions

U.S. EPA is currently overseeing implementation of an Administrative Order on Consent (AOC) for Revegetation and Stabilization of hillside areas within the Site. This AOC was signed in October, 1990 by U.S. EPA, Gulf Resources & Chemical Co. and Hecla Mining. The AOC calls for the revegetation of 3,200 acres of eroding hillsides having less than 50% cover within the Site, contour terracing of steep slopes to control erosion and increase infiltration, erosion control and sedimentation retention structures, and control of water and wind erosion of selected mine dumps. U.S. EPA approved workplan for Hillsides Stabilization and Revegetation provide for achievement of 85% ground cover on existing barren hillsides within approximately 8 to 12 years.

Zero gradient contour terraces are being constructed on the selected barren and sparsely vegetated hillside to the south, east, and west of the Smelter Complex. Sediment retention treatment basins are being constructed in the major tributaries within the Smelter Complex area for the purpose of reducing the suspended sediment/contaminant loadings in surface runoff to the SFCDR. These detention structures receive storm flows from Deadwood, Magnet, and Government Gulches. Additional details of the work to be performed are found in the AOC work plan which is available in the Administrative Record repository at the Kellogg library. In addition to the revegetation actions specified on approximately 3200 acres in the Hillsides AOC workplan, U.S. EPA is requiring that severely eroding hillside areas having less than 50% cover, within areas of greater cover (50%+), are also revegetated consistent with the methodology outlined in the AOC. The revegetation efforts apply to areas where there is a high potential for contaminant transport and the net impact of planting access is not greater than the benefit. Specific areas to be added to the revegetation efforts will be determined by additional field investigations conducted during the Remedial Design phase; however, the additional acreage is expected to be less than 500 acres. Additional emphasis is also placed on re-establishment of riparian habitat and stream corridor vegetation under this action, although establishment of runoff filtering areas adjacent to stream corridors and drainage ways is an integral component of the Hillsides AOC. In general, efforts will be undertaken to establish a vegetated stream corridor of 100 feet width at a minimum. Specific plans for each stream corridor being remediated will be developed during Remedial Design in conjunction with development of Hillsides AOC workplans. Respondents to the AOC have established Test Plots to determine which revegetation strategies will be most effective on the hillside areas. The results of the test plots will be used to determine the best revegetation applications. Monitoring of the performance and maintenance of erosion control measures and sedimentation structures will continue until revegetation efforts have been successful in controlling erosion and sedimentation of the hillside areas. Future work will be consistent with action taken to date in accordance with the October 1990 AOC. Detailed design and construction documents for hillside actions have been prepared as required by the AOC and are available for review in the Administrative Record. Also included in the AOC work plans are site specific plans for closure of mine rock dumps identified as posing a direct contact or erosion hazard.

In order to minimize contact between Milo Creek surface water and tailings and mine waste rock on the Milo Gulch floor, and reduce contaminant transport to the SFCDR as suspended sediment during runoff events, Milo Creek will be channelized and lined from the Wardner Water System intake to the culvert which directs stream flow beneath Wardner and Kellogg. Lining of Milo Creek may also reduce recharge to the Bunker Hill Mine workings.
Operation and Management plans will be developed during remedial design for all hillside actions in order to assure continued effectiveness.

9.2.2 Smelterville Flats

Remedial actions for Smelterville Flats consist of actions to control migration of windblown dust, minimize direct contact risk, and control contaminant migration to surface and ground water. Consistent with other remedial actions to treat contaminated surface and ground water at the Site, over 100 acres of jig tailings-contaminated alluvium will be removed from the northwestern portion of the flats adjacent to the SFCDR for the creation of constructed wetlands for the treatment of surface and ground water; this material will be consolidated in the CIA. Additional details on the conceptual design of this system are provided in the Constructed Wetland Technical Memorandum available at the Administrative Record repository.

Along with the construction of the wetlands, a floodway with a protective dike will be constructed on the south side of the SFCDR. The floodway will be a minimum of 500 feet wide and the dike will be designed to protect Smelterville Flats and the wetlands treatment system from a 100 year, 24 hour storm event. Accessible tailings in those portions of the floodplain of the SFCDR being modified for floodway construction will also be removed and disposed of in the CIA. Additionally, all exposed tailings along the banks of the SFCDR within the Site will be stabilized to prevent erosion, or removed for consolidation within the CIA. Remedial design for any modifications within the floodway, and all bank stabilization measures, will incorporate aquatic habitat considerations. Appropriate State and Federal natural resource agencies will be consulted in developing site specific habitat considerations. For example, stream corridor configuration and revegetation of river banks can be designed to maximize benefits to aquatic resources.

Implementation of these measures will result in improvements to ground water and surface water quality due to the removal of these materials to an area that will be resistant to infiltration and isolated from contact with ground water and surface water.

The jig tailings/alluvium mixture that will remain in Smelterville Flats will be capped with a minimum of six inches of soil to enhance revegetation efforts and minimize direct contact risk.

Alternatively, contaminated surfaces will be covered with a more permanent barrier, consistent with current land use (revegetation is the preferred remedial action and will be required unless land use necessitates a more durable barrier). As with other areas of the Site, if land use conversions occur in Smelterville Flats a barrier consistent with the new land use will be required in those locations where lead concentrations in the top foot of soil exceeds 1,000 ppm. This cleanup goal is consistent with the remedial action level in the Residential Soil ROD. An institutional controls system will be the mechanism used to ensure that appropriate barriers are installed and maintained on Smelterville Flats as land use conversions occur. Approximately 500 acres of Smelterville Flats will be removed or capped. Jig tailings/alluvium removed from Smelterville Flats will be placed in the CIA prior to its closure.

Additional remedial actions specified for Smelterville Flats include a system for capturing and treating ground water being discharged to the SFCDR in the areas immediately east of Pinehurst Narrows. This system is discussed in greater detail in section 9.2.10 - Constructed Wetlands Treatment System.

9.2.3 Central Impoundment Area

The remedial actions proposed for the CIA focus on minimizing releases from this source by installation of a cap designed to minimize infiltration through jig tailings and Central Treatment Plant sludges disposed of in this area. The CIA will also serve as a repository for consolidation of jig tailings/alluvium, gypsum and slag removed as a component of other remedial actions. The cap will be designed to have a hydraulic conductivity of less than 10^{-6} cm/sec. After grading of the CIA surface and dikes to promote runoff, the cap will be composed of a minimum of twelve inches of low permeability material overlain by a minimum of six inches of clean soil suitable for revegetation. Other engineering designs meeting these criteria will be considered. Cap design and revegetation requirements will be consistent with potential future land use. Prior to closure of the CIA, material accumulations originating from the 1982 Smelter Complex cleanup will be removed and returned to the Smelter Complex. A determination will be made regarding whether the material will be recycled, reprocessed, or treated via cement based stabilization prior to being capped in the Smelter Closure. The process for making this determination is detailed in Figure 9-1. Surficial soils on the CIA dikes and areas surrounding the CIA will be capped, as appropriate, consistent with current land use. At a minimum, six inches of clean soil will be placed to enhance revegetation. The slag pile on the west end of the CIA will be relocated either to the Smelter Complex or the east cell of the CIA prior to capping.

Included in the CIA closure is installation of a system to recover and treat contaminated ground water surfacing north of the CIA. This recovery system will be designed to maximize the efficient interception of contaminated ground water from the "CIA Seeps". Water collected from the seeps will be conveyed to the constructed wetlands treatment system before release to the SFCDR. The performance standards for the constructed wetland treatment system are discussed in section 9.2.10.

9.2.4 Page Pond

Page Pond is a former tailings disposal area resulting from mineral mining and concentrating activities at the former Page Mine. This area contains tailings that contribute to localized contamination of surface and ground water and serves as a source of windblown dust. The Page Pond currently serves as a repository for soils removed from residential properties as well as the site for the South Fork Sewer District Water Treatment Plant. The remedy for Page Ponds calls for the removal of approximately 40-60 thousand cubic yards of jig tailings accumulations from the West Page Swamp area and the subsequent placement of this material on the Page Pond benches as a sub-base for a vegetated cap. The final extent of material to be removed from West Page Swamp will be determined during Remedial Design and will consider current vegetated status, surficial soil contaminant concentrations, water levels, and habitat. The regrading and capping of Page Tailings Impoundment with residential soils will serve as a barrier to direct contact with tailings within this impoundment and will facilitate revegetation efforts in that area. In addition, the cap will decrease the leachate generation of the Page Pond area by promoting runoff and evapotranspiration compared to current conditions. Impoundment dikes will also be regraded and then vegetated after placement of a minimum of six inches of clean soil. Existing fencing will be maintained to limit access. Wetlands associated with the Page Pond areas will be evaluated for water quality, habitat considerations, and biomonitoring in order to assess environmental conditions resulting from remedial actions. U.S. EPA and IDHW will work with the appropriate state and federal natural resource management agencies to determine appropriate management and operations of the area.

Under this alternative Humboldt and Grouse Creeks will be isolated, to the degree practicable, from contact with Page tailings accumulations by the use of diversions and channel modifications. The objective is to minimize the contamination of these surface streams by preventing contact with jig tailings. Some benefits will also accrue to ground water as the diversions can be designed to minimize surface water contributions to the ground water system underlying Page Ponds. Final configurations of any channel modifications will be determined during Remedial Design and will include habitat considerations. Appropriate State and Federal natural resource management agencies will be consulted in determining the most appropriate design.

9.2.5 Smelter Complex and Mine Operations Area (MOA)

The Smelter Complex and Mine Operations Area include those areas of the Site that comprise the former active mining, milling, and material processing areas of the Site. This area typically contains the most highly contaminated areas of the Site with metal concentrations of material accumulations and soils well into the percentage range in many instances. The Remedial Investigation (RI) Report includes summary tables documenting material accumulations found within the Smelter Complex and MOA. In addition to material accumulations, the Smelter Complex and MOA contain numerous contaminated structures in an advanced state of deterioration. The Smelter Complex and MOA present a continuing threat to the community due to the risk of fire and the threats posed to trespassers on the property.

the community due to the risk of fire and the threats posed to trespassers on the property. Contaminant migration via wind and water is also a major concern. Acid mine drainage from the Reed and Kellogg tunnels or other mine portals where the drainage from the Bunker Hill Mine is collected will also require collection and treatment.

Remedial actions selected for the Smelter Complex and MOA focus on limiting direct contact with contaminants and controlling migration of contaminants to surface and ground water. Following removal and reprocessing, recycling, or cement-based stabilization of Principal Threat (threshold concentrations provided in the table below) material accumulations and soils within the Smelter Complex and MOA, the Lead Smelter and the Zinc Plant structures will be demolished in place and prepared for capping after removal of salvageable items, such as steel, timber, and equipment. Salvage material will be decontaminated consistent with the proposed rule for Best Demonstrated Available Technology (BDAT) treatment technologies for contaminated debris published in the Federal Register, January 9, 1992. Recycling and reprocessing of material accumulations and demolition debris will be utilized to the extent practicable in order to minimize material in the Smelter closure. MOA structures will be decontaminated consistent with intended use and maintained for future utilization, where feasible, or demolished. Prior to demolition, PCB-containing equipment will be managed consistent with applicable Toxic Substance Control Act (TSCA) regulations. Asbestos containing materials will also be managed consistent with applicable regulations during all closure activities. Demolition of the Lead and Zinc tall stacks are not required as part of this action; however, they must be decontaminated.

The Smelter Complex is composed of three principal areas for the purpose of this discussion; the Lead Smelter, Zinc Plant, and Mine Operations Area. Associated material storage sites and related areas are also considered part of the Smelter Complex. The following discussion focuses on these three principal areas. Materials accumulation sites and associated soils that have been impacted by contamination from mineral processing facilities (e.g., lead smelting, zinc refining, etc.) are slated for removal and consolidation within the Lead Smelter and Zinc Plant closures since these wastes are generally of higher concentration and require a greater level of management in order to insure a protective remedy. A subset of these materials comprises the Principal Threat materials of the Site. The parameters of this subset are outlined in a separate Principal Threat Technical Memorandum which is part of the Administrative Record for the Site. Table 9-1 lists the action levels for the Principal Threat materials. Principal Threat materials will be reprocessed, recycled, or treated via cement-based stabilization under this remedial action to address the statutory preference for treatment of Principal Threat Wastes (Figure 9-1).

Figure 9-1

Material Accumulation Flow Chart

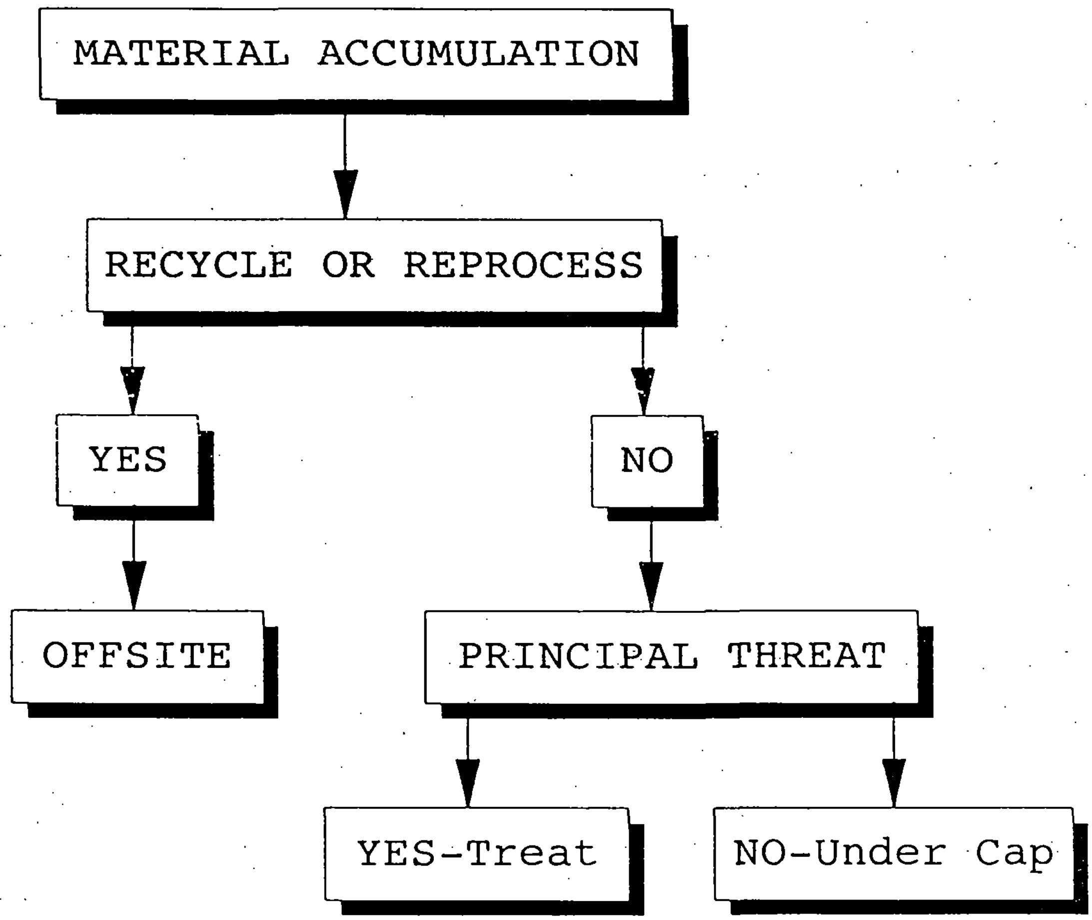


TABLE 9-1 Principal Threat Action Levels*		
Metal	ppm	Percent
Antimony	127,000	12.7%
Arsenic	15,000	1.5%
Cadmium	71,000	7.1%
Lead	84,600	8.5%
Mercury	33,000	3.3%

* Material accumulations or soils are considered to be Principal Threat Wastes if the concentration of any constituents exceeds the levels.

Lead Smelter

Other materials within the Smelter Complex to be consolidated in the Lead Smelter closure include:

- contaminated materials and soils from the "boneyard area" south of the Lead Smelter;

- some slag from the west cell of the CIA to aid in preparation of the Site for the final cap;

- residential soils collected during other remedial actions may be consolidated within the smelter closure as needed to facilitate preparation of the Site for capping and revegetation;

- Smelter Complex cleanout material (removed from the Smelter Complex by Gulf in 1982) currently located in the CIA, approximately 31,000 cubic yards;

- material removed within the MOA during remediation of that area, including the "boulevard area";

- material accumulations and contaminated soils, including former waste disposal or holding ponds sediments within the Smelter Complex;

- cleanup material from MOA buildings decontaminated to allow for future industrial utilization;

- Magnet Gulch cleanup material accumulations and contaminated soils;

- treated Principal Threat material, including the Copper Dross Flue Dust Pile which was recently removed from Magnet Gulch for temporary storage in the Lead Smelter Complex where it awaits cement based stabilization; and,

- other materials/soils determined during Remedial Design to be appropriate to consolidate in this area.

Zinc Plant

The Zinc Plant closure will include material from the Zinc Plant, Phosphoric Acid/Fertilizer Plant areas (excluding the fertilizer warehouse), contaminated soils in the vicinity of the Zinc Plant and upper Government Gulch, and material, debris, and contaminated soils from the fertilizer plant. Any of the materials destined for the Zinc Plant closure could also be placed in the Lead Smelter Closure if the Zinc Plant closure is at capacity.

Mine Operations Area

Surface soils and material accumulations within the MOA will either be removed for consolidation within the lead smelter closure, treated as Principal Threat wastes and consolidated within the lead smelter closure, or capped in place with a barrier consistent with land use. Remediation of the MOA is expected to include considerable removal of material due to high levels of contamination found in this area and the anticipated future land use. In determining whether soils in the MOA and Smelter Complex (outside of the capped area) are removed to be consolidated in the Lead Smelter and Zinc Plant closures, an evaluation of the characteristics of material accumulations will be conducted during Remedial Design. All material accumulations and associated soils will be removed and consolidated in the Lead or Zinc Plant closures if they exhibit concentrations in excess of what would typically be attributed to mine waste rock or tailings. Remedial Design will include a process for determining the extent of excavation in areas impacted by material accumulations. In all cases a minimum of six inches of clean soil or other barrier appropriate to land use, will be applied as a cover where surface concentrations exceed 1,000 ppm lead.

Currently, a portion of the acid mine drainage from the Bunker Hill Mine is conveyed from the Kellogg Tunnel to the CIA for subsequent treatment in the Central Treatment Plant (CTP). All acid mine drainage will be conveyed to the CTP for pre-treatment followed by further treatment in the constructed wetland treatment system to be located in Smelterville Flats. During remedial design the adequacy of the existing CTP to pretreat mine water will be evaluated to determine if modifications to this facility are needed to meet water-quality-based effluent limits which will be imposed on the constructed wetland treatment system outfall. This remedial action is consistent with the requirements of a U.S. EPA Administrative Order issued in 1991. The order requires that a closure plan for the Bunker Hill Mine be developed and implemented which addresses acid mine drainage from the mine as well as other environmental considerations.

Closure Considerations

Upon demolition of the Lead Smelter and Zinc Plant, and consolidation of material accumulations and contaminated soils, including treated Principal Threat materials, both of these facilities will be closed. The Principal Threat materials remaining after recycling and reprocessing options have been implemented will be treated via cement-based stabilization fixation.

The objective of cement-based stabilization/fixation is to reduce the mobility of contaminants. Relevant and appropriate requirements of RCRA Land Disposal Restrictions (LDRs) for cement-based stabilization of Principal Threat waste are expected to be attained. While LDRs for mineral processing wastes have not been promulgated (and therefore are not applicable), U.S. EPA has determined that it is appropriate to achieve the percent reduction and/or extract concentration criteria goals set forth in the LDRs for immobilization of inorganic compounds. Treatability tests for cement-based solidification of one of the major Principal Threat waste material accumulations onsite (the Copper Dross Flue Dust recently moved from Magnet Gulch to the Smelter Complex) indicates that attainment of percent reduction goals based upon TCLP protocols is likely. However, due to the varying solubilities of contaminants of concern through a range of pH values, U.S. EPA has determined that the acid leaching aspects of the TCLP test protocol are not appropriate for wastes consolidated in the Lead Smelter Closure, and has elected to design a stabilization mixture that will achieve LDR percent reduction goals and/or extract concentration criteria at a pH reflective of actual onsite conditions. A rain water leach test which approximates onsite conditions has been determined to be appropriate; a modification of U.S. EPA Method 1320 will be used. Treated Principal Threat materials will be consolidated in concrete substructures (basements, storage bins, etc.) within the Lead Smelter Complex unless other areas are determined to be appropriate by U.S. EPA during Remedial Design.

Closure of the Lead Smelter and Zinc Plant will consist of a minimum of one foot of low permeability material or a soil/geosynthetic cap (or an appropriate combination of the two) that will have an in place hydraulic conductivity of less than or equal to 10^{-7} cm/sec to minimize water infiltration and subsequent contaminant migration. Other appropriate RCRA 40 CFR Part 264, Subpart G requirements for closure of existing facilities will be incorporated into the closure design, including: leachate collection and treatment, runoff and runon controls, monitoring, and operation and maintenance considerations.

Other Smelter Complex Remedial Actions

The surface water actions selected for the Smelter Complex include channelizing and lining of Government Creek, with diversion and treatment of base flows in the Collected Water Wetland. A cutoff wall will be constructed south of the Zinc Plant in order to divert relatively uncontaminated water around the closed industrial complex. A second cutoff wall will be constructed at the northern end of the gulch to facilitate the collection of contaminated ground water and surface water within the area. This water will be shunted to the constructed wetland treatment system planned for Smelterville Flats under this alternative. The Remedial Design for these components of the remedial action will seek to maximize recovery of base flow contaminated ground water and surface water for treatment and divert uncontaminated surface water and ground water around the closed industrial complex to the SFCDR. Bunker Creek base flows will also be conveyed to the wetland treatment systems if water quality sampling indicates exceedances of FWQC.

The existing storm water drainage system in the MOA will be maintained and the mill settling pond (Concentrator Reservoir) will be closed. Any sludge remaining in the bottom of the mill settling pond will be consolidated in the Lead Smelter closure.

The A-1 Gypsum Pond sediments located in Magnet Gulch will be removed and relocated to the CIA prior to closure of that area. The A-4 Gypsum Pond sediments, located north of McKinley Avenue at the mouth of Magnet Gulch, will either be capped in place or moved to the CIA along with the A-1 Gypsum Pond. The final determination regarding this aspect of the selected remedy will be based upon the engineering feasibility of closing the A-4 Gypsum Pond in place and additional consideration of ground water and surface water hydrology in that area. If a cap is selected it must minimize infiltration through the A-4 Gypsum Pond and be of low maintenance. Relocation the A-4 Gypsum Pond sediments within the CIA closure would have the additional benefit of making an area available in the former A-4 Gypsum Pond location for construction of a sedimentation basin for detention of runoff from the Smelter Complex, Bunker Creek, and Deadwood Gulch.

Other existing solid waste landfills within the Smelter Complex will be closed consistent with appropriate RCRA 40 CFR Part 264 requirements (Subpart N). A low permeability soil cover system will be constructed over the solid waste landfills located on the east side of Deadwood Gulch south of the mine/mill crusher plant in order to reduce surface infiltration through potential source materials. Capping the landfills is expected to reduce potential ground water loadings from these sources. Upon completion of remedial activities, all disturbed areas will be re-vegetated or other appropriate permanent barrier installed.

9.2.6 Rights-of-Way

All rights-of-way (ROW) within the Site will be managed to minimize contaminant migration and direct contact risk. The ROWs remedial action determinations will necessarily be site specific based upon location, utilization, and contaminant concentrations. In general all ROWs will receive one or more of the following treatments: access control, capping (i.e., barrier consistent with land use), or removal/replacement. Capping will be the predominant action utilized in Non-populated Areas; however, in areas within the Smelter Complex/MOA removal and replacement will be favored. Where caps are determined to be appropriate during RD, they will be consistent with land use and will have suitable durability; for example, in the case of overhead power lines the method of remediation will be consistent with the other areas around the ROW. Within residential areas, ROWs adjacent to residential properties will be treated consistent with the remedial action selected in the Residential Soils ROD. In all cases, ROWs contributing to contaminant migration via air or water will be addressed. ROWs include all state, county, local and private roads.

9.2.7 Commercial Buildings and Lots

Commercial buildings and lots include public buildings, parks, churches, as well as commercial properties. Risks posed by commercial buildings and lots are similar to those in residential settings. While the duration of exposure in commercial settings may be less, on the average, than a residential setting, the most sensitive portion of the population must still be protected. Consequently, this action requires remedial actions similar to those for residential areas. In existing commercial settings soils exceeding a lead concentration of 1,000 ppm in the top 1 foot, must receive a protective barrier consistent with land use. Barriers may include a minimum of six inches of clean soils or gravel, or a paved surface. Final decisions regarding barriers performance standards will be developed during Remedial Design or as a component of the institutional control program. Commercial properties used predominantly by sensitive populations will require a 12 inch soil barrier. As new commercial uses are undertaken the same approach to barrier management will be required. The institutional control program planned for the Site will provide specific performance standards for various barrier systems. Proper disposal of material excavated during commercial development is a key component of this remedy. Soils may be consolidated within the Page Pond tailings impoundment, or the Smelter Complex, until closure of Smelter Complex is complete.

With respect to interiors of commercial properties, the institutional controls program will encourage interior cleaning of properties and provide guidelines for replacement of carpets, floors, and insulation of existing structures.

9.2.8 Residential Interiors

The remedial actions presented here are intended to complement actions selected in the Residential Soils ROD issued by U.S. EPA in August of 1991. To provide a protective remedy for Site residents the following components are included:

- Continuation of blood lead monitoring in conjunction with educational programs currently provided by the Panhandle Health District.

- Continuation of the high efficiency vacuum loan program.

- Development of institutional control programs for home remodeling activities, including the normal replacement of carpets, floors, and attic insulation.

- All homes with house dust lead concentrations equal to or exceeding 1000 ppm lead will have a one time cleaning of residential interiors after completion of remedial actions that address fugitive dust. If subsequent interior house dust sampling indicates that house dust lead concentrations exceed a site wide average of 500 ppm lead the need for additional cleaning will be evaluated.

- Home interiors of children identified through health screening will be evaluated and if needed site specific remediations will be performed.

- Additional interior dust studies will be developed during remedial design to identify sampling and decision making criteria for the one time cleaning.

9.2.9 Future Development in Non-populated Areas

With the exception of certain areas within the Site that are integral components of the remedial actions (e.g., Lead Smelter cap and constructed wetland systems), currently undeveloped areas of the Site may be utilized in the future, consistent with local land use controls.

The institutional controls program will guide the establishment of effective barriers in areas where surficial (top one foot) soil lead concentrations exceed 1,000 ppm lead. In areas where lead concentrations are below 1,000 ppm lead no special considerations will be required beyond those typically required for new developments. The exception to this would be creation of a new residential development in a currently undeveloped area of the Site. Such a development would have to have an average residential yards lead concentration less than 350 ppm lead, with no property exceeding 1,000 ppm lead, and would need to be effectively isolated from nearby areas that would expose residents to surficial lead soil levels exceeding 1,000 ppm. New developments not meeting these criteria will require remediation prior to residential use as described in the Residential Soils ROD.

Non-populated Areas with the potential for future development will be remediated to address current human health and environmental concerns as discussed in this section. Remediation activities specific to conditions at future land use locations will be implemented, as appropriate, as development occurs via institutional controls (see Section 9.2.14).

9.2.10 Constructed Wetland Treatment Systems

Two constructed wetland treatment systems are selected for the innovative treatment of surface water and ground water. The first system (Collected Water Wetland) will occupy approximately 74 acres in Smelterville Flats and is intended to treat CIA seeps, pre-treated acid mine drainage, contaminated surface and ground water from Government Gulch, leachate from the Lead and Zinc Plant closures, and other selected surface water flows. The U.S. EPA is selecting this system based upon information presented in the FS, supporting Technical Memoranda, an independent review of the literature. The system would operate by adsorption and precipitation of metallic sulfides within an anaerobic wetlands substrate. The contaminants would remain bound in the wetland as long as the substrate remains anaerobic and saturated. This system will be designed to maximize removal of contaminants from treated waste streams as early as practicable. After source control remedial actions are in place and the system operation has been optimized, it is U.S. EPA's expectation that the constructed Collected Water Wetland treatment system will treat approximately eight CFS of contaminated water to a minimum of 90% removal efficiency and will meet water-quality-based effluent limits prior to discharge to the SFCDR. Currently the SFCDR is a water quality limited stream segment; however, the IDHW, U.S. EPA, the Coeur d'Alene Tribe, and other interested state federal and local agencies are considering developing a Total Maximum Daily Load (TMDL) for the SFCDR, as required by the Clean Water Act. Discharge limits for the Collected Water Wetland and Ground Water Wetland effluents will be determined as this process evolves as part of the Coeur d'Alene Basin Restoration Project. Should the Collected Wetland Treatment System not meet both 90 percent reduction criteria and water-quality-based effluent limits meeting the substantive requirements of an NPDES permit, pretreatment of influent contaminant streams or modifications to the treatment systems will be required.

The second system, the 34 acre Ground Water Wetland system selected for treatment of ground water is described in greater detail in the FS and supporting Technical Memoranda. In general, this system is intended to treat upper zone ground water flowing towards the SFCDR in the western portion of Smelterville Flats. This system will be designed to maximize the efficiency of contaminated ground water capture in this area and maximize removal of contaminants from ground water early as practicable. After source control remedial actions are in place and the system operation has been optimized, it is U.S. EPA's expectation that the constructed Ground Water Wetland treatment system will treat approximately three CFS of contaminated water to a minimum of 90% removal efficiency and will meet water-quality-based effluent limits prior to discharge to the SFCDR. Should passive collection of ground water for treatment not prove effective, active collection (i.e., pumping) will be required to achieve recovery of contaminated ground water. Modifications to the treatment process will be required if performance standards noted above are not achieved.

For both systems, long term management of wetland substrate and operations and management considerations will be an integral part of the Remedial Design.

9.2.11 Public Water Supply Considerations

The current availability of an offsite potable water supply for most Site residents effectively limits the use of onsite water for domestic purposes; however, adequate supplies of suitable water must continue to be available to minimize exposure to onsite surface and ground water. Should offsite potable water become unavailable, additional actions may be required to assure a safe drinking water supply until onsite sources are restored to a suitable quality. As discussed previously, restoration of onsite water resources is dependent upon control of upgradient sources of contamination to surface and ground water as well as onsite remedial actions.

Except as noted below, all ground water wells within the Site that are in the main valley aquifer, either upper zone, lower zone, or other contaminated wells within the Site will be closed or abandoned according to the State of Idaho requirements. Existing domestic wells selected for closure will be replaced by an existing alternative water supply if the residence is not already serviced by a municipal water system. Industrial wells will be replaced by an alternative water supply as needed. Monitoring and aquifer test wells will not require replacement with an alternative water supply. Monitoring wells will be closed if they are not required for continued monitoring. Approximately 48 domestic wells, 43 industrial wells, and 317 monitoring wells will be closed.

9.2.12 Soil Action Levels

Remedial actions for specific areas of the Bunker Hill Superfund Site are outlined earlier in this Section. Additional details on these remedial actions are provided in the FS description of Alternative 3 and supporting Technical Memoranda. In general, the decision regarding how a particular area of surface contamination is addressed is a function of the area it is within. Areas that are primarily impacted by a mixture of tailings and alluvium (soil) are suitable for capping. These areas represent a high volume, low concentration source that is appropriately managed by a combination of containment technologies and institutional controls. This approach is consistent with U.S. EPA's previously issued Residential Soils ROD.

Areas that have been impacted by contamination from mineral processing facilities (e.g., lead smelting, zinc refining, etc.) are slated for removal since these wastes are generally of higher concentration and require a greater level of management in order to insure a protective remedy.

For the purposes of this ROD, clean replacement soils are considered to contain less than 100 ppm lead, 100 ppm arsenic and 5 ppm cadmium.

9.2.13 Operations and Maintenance Requirements

Specific Operations and Maintenance (O&M) requirements for all remedial actions selected in this Record of Decision will be developed during the Remedial Design process. O & M requirements are an integral component of remedial actions and must be planned and implemented to ensure the long term effectiveness of selected measures. Long term protection of human health and the environment is dependent upon the successful maintenance of barriers, facility closures (i.e., CIA, Smelter Complex), erosion control structures, channel liners, and contaminant treatment systems. O & M requirements must also be designed to complement institutional control and Monitoring programs which are discussed below.

9.2.14 Institutional Controls

Institutional controls, which include a variety of legal restrictions and regulations on the use of land where potentially hazardous levels of contamination will remain after completion of this remedy, are an important component of remedial actions for the Bunker Hill Superfund Site. The Residential Soils ROD issued in 1991 requires the use of institutional controls for maintenance of residential soil barriers to prevent human contact with contaminated soils after removal and replacement of contaminated surficial soil.

This remedy also relies upon institutional controls to assure the protectiveness of selected remedial actions, including certain hillside areas within the Site which have surface soil concentrations that exceed residential soil cleanup goals for lead, and which are likely to be developed in the future. Institutional controls will guide the future development of these areas to ensure that appropriate remedial actions are taken, including the use of protective barriers on contaminated soils, to protect future residents and users of such areas from exposure presenting unacceptable risks. In addition, institutional controls will assist landowners who undertake projects by providing guidance and certification of compliance with the institutional controls regulatory program.

The NCP sets out U.S. EPA's expectation that institutional controls "shall not substitute for active response measures [that actually reduce, minimize, or eliminate contamination] as the sole remedy unless such measures are determined not to be practicable." 40 CFR Part 300.430(a)(1)(iii)(D). Nevertheless, where active remediation is not practicable, institutional controls may be "the only means available to provide for protection of human health." 55 Fed. Red. 8666, 8706 (March 8, 1990). In addition, institutional controls may be "a necessary supplement where waste is left in place as it is in most response actions." Id.

Accordingly, U.S. EPA has determined that institutional controls are both an acceptable and integral component of remedial actions for both the Residential Soil ROD and this Non-populated Areas ROD. Institutional controls have been identified and evaluated in the Residential Soil Feasibility Study and RADER, and U.S. EPA and IDHW have participated in the development of the Panhandle Health District's evaluation of such controls in the Populated Areas. Institutional controls were also evaluated in the Non-populated Area FS.

The January 25, 1991, Draft "Evaluation of Institutional Controls for the Populated Areas of the Bunker Hill Superfund Site," prepared for the Panhandle Health District outlines the need for and purpose of a comprehensive Institutional Controls Program (ICP) for the Bunker Hill Site. There are four main components of the ICP, including:

1. An Environmental Health Code;
2. Performance Standards for remedial actions (e.g., specifications for barriers);
3. An educational program for residents and contractors to familiarize themselves with ICP requirements;
4. A testing and monitoring program to evaluate the effectiveness of the ICP.

The Panhandle Health District held numerous meetings with local elected officials regarding the development and implementation of the ICP. On February 24, 1992, the Panhandle District Board of Health formally approved the Panhandle Health District's involvement as the management entity for the Institutional Control Program and their commitment to amend the existing Environmental Health Code to include specific Contaminant Management Regulations and performance standards. In May 1992, the Panhandle Health District completed a draft of an Environmental Health Code, also known as Contamination Management Regulations.

Once finalized and adopted, the Contaminant Management Regulations will be incorporated into the Panhandle Health District's Environmental Health Code, and are expected to govern all excavations, building, development, grading and renovations within the Site and potentially other areas affected by heavy metal contamination within the Panhandle Health District's jurisdiction in Shoshone County.

The Environmental Health Code will also include specific performance standards to regulate and provide guidance for all activities encompassed by the ICP. The performance standards will establish minimum requirements when barriers are to be established or breached and will govern the following activities:

1. Building Interior Construction/Modification
2. Exterior Construction
3. Subdivision Development
4. Transportation
5. Disposal
6. Clean Materials Supply Program

After adoption of the Environmental Health Code and performance standards, the Panhandle Health District will then develop an educational program component of the ICP, based on the final ICP performance standards. The Panhandle Health District will then administer and oversee the testing and monitoring component of the ICP.

In addition, the Health Intervention Program, as described below, will be continued at least through the completion of remedial action. This program identifies children and pregnant women who are being impacted by lead exposures and provide intervention activities to mitigate such exposures.

Blood lead screening should continue as it is currently being performed until the Remedial Action is completed and the blood lead concentrations Remedial Action Objective is met. This RAO requires that blood lead levels decrease until 95% of the children tested-have blood lead levels below 10 μg/dl with less than 1% of children having blood lead levels above 15 μg/dl.

The objective of the screening program will continue to be the identification of children who have elevated blood lead levels and need follow up to reduce lead exposures. The Centers for Disease Control guidelines for follow up activities will be used to determine appropriate intervention response. Outlined below are specific response actions for blood concentration ranges.

$\mu g/dl$	Follow Up Response
10-14	Provide rescreening and community-wide childhood lead poisoning prevention activities. These prevention activities will be part of the Institutional Control education program.
15-19	Response as listed for 10-14 $\mu g/dl$ plus home visits by health professional and provide nutritional and educational intervention. If appropriate, recommend a special education evaluation for school age children by the local school district.
20-44	Responses as listed for 15-19 $\mu g/dl$ plus recommend a visit to a family physician.

Children between the ages of 9 months to 9 years will be included in the program. The program will continue to offer incentives to children for having their blood tested. A house dust sampling program will be continued. Home visits would include environmental evaluations which examine house dust, residential soils, vegetable gardens and paint.

Pregnant women will also be screened. However, no incentives would be provided, as is the case for children. Women with blood lead levels greater than 10 $\mu g/dl$ would be referred to their physician for medical evaluation. Additionally, a home visit would be conducted and the expectant mother provided with nutritional and intervention information.

Once remedial actions are completed and blood lead levels have decreased to meet the RAO described above, the health intervention program will be scaled back to provide blood lead testing upon request only. The same follow up responses for children and pregnant women with elevated blood lead levels will be activated. However, the number of individuals needing follow up would be low.

The Panhandle Health District has stated that it will only manage and administer the ICP for as long as it is funded, as the Panhandle District Board of Health has not, and will not, authorize funding for any of the Institutional Control Program activities. Community acceptance of the ICP program, as expressed during the public comment period, is also conditioned on such controls being self-sustaining with no additional costs to Site residents or local governments.

9.2.15 Monitoring

Extensive monitoring of soil, water, and air is an important component of the remedial actions outlined in the ROD. Monitoring is required for the following purposes, in addition to those that may be required during Remedial Design.

- To evaluate compliance with ARARs in surface and ground water .

- To assess the status of environmental receptors (i.e., biological monitoring)

- To evaluate the performance of specific remedial actions and their respective O & M programs

- To evaluate success in meeting public health protection goals (i.e., continuation of blood lead screening program)

- To evaluate the adequacy of control measures instituted during implementation of remedial actions.

Monitoring programs will be utilized to evaluate the success of remedial actions in protecting human health and the environment and will serve to assist U.S. EPA in determining the adequacy of remedial actions selected in this ROD.

9.2.16 General Remedial Design/Remedial Action Considerations

During remedial actions certain activities will have to be maintained or implemented to protect human health and environment. These activities include; dust control, access control, fire control, and the management of the release of contaminants during remedial construction activities.

During remedial construction activities, dust control measures will be implemented site wide to prevent the transport of contaminated material. The dust control activities can include the use of water to wet down areas or polymeric, chemical, or physical surface sealers for temporary dust control. Some of the areas that will receive temporary dust control include Page Pond and CIA surfaces and dikes, roads in the populated and non-populated ROW, Smelterville Flats, the Smelter Complex, and other source areas that generate fugitive dust. Institutional controls will also be applied to restrict access to potential source areas to control transport of contaminants within the site and exposures to contaminants of concern.

Access control will be maintained in all areas where it currently exists until the remediation in that area is completed. Access controls will also be used to prevent exposures during remedial actions. Access controls will include fencing, signs, and security patrols and guards.

Fire control will be in place until remedial actions are completed in the Smelter Complex and MOA. Fire control will include quarterly inspections of all structures until they are either demolished or decontaminated. The necessary fire protection materials, including the necessary water supplies, will be maintained as long as the potential for release of contaminants through fire exists. This will include coordination with the local fire district to provide the necessary information for safe access should it be necessary to fight a fire. Also included in fire control is the use of fire protection during all activities involving potential ignition sources, such as cutting and welding activities. These activities include wetting down areas prior to these activities, having fire extinguishers at hand, and providing a fire watch for an appropriate period after all ignition sources have been abated.

The management of the release of contaminants during remedial construction activities will also be performed. This will include the management of high flow runoff to minimize sediment transport in surface water. Storm water management during remedy implementation will be consistent with all State and local requirements. Best Management Practices employed during remedial action implementation will include extensive use of storm water detention facilities to minimize impacts from runoff events until monitoring of remedial actions have demonstrated their effectiveness in mitigating contaminant loading from runoff events.

Any repairs required to community infrastructure, such as roads and utilities, due to the implementation of remedial actions required in this ROD, will be implemented as appropriate.

9.3 CHANGES TO PROPOSED PLAN

Residential soils were originally intended to be consolidated on Page Pond or another suitable area onsite. For clarification, it is also appropriate to utilize residential soils as a sub-base material for the closure of the Lead Smelter and Zinc Plant, or as a component of the final cover of these closures if surface concentrations are below 1000 ppm lead and access is controlled.

Language has been added to Section 10 of this ROD to clarify when the contingent waiver of ground water ARARs in the main valley aquifer would become effective based upon technical impracticability. It has been further clarified that, while remedial actions outlined in this ROD seek to limit the impacts of site contaminant sources on the SFCDR, achievement of FWQC in the river is beyond the scope of this ROD and attainment of FWQC in the SFCDR is not an ARAR for this ROD.

Preliminary results of treatability testing of Principal Threat material accumulations indicate that a rain water leach test is more appropriate under the circumstances of this release than the acid leach test typically utilized for design of stabilization mixtures meeting LDR requirements. Therefore, a rain water leach test will be used in lieu of an acid leach test to design the cement-based stabilization mixture for treatment of Principal Threat waste. This test will be a modification of U.S. EPA Method 1320 utilizing water with a pH representing local conditions, rather than acidified water.

9.4 QUANTITY OF MATERIALS REMOVED, CONTAINED, AND TREATED

Table 9-2 provides a summary of quantity of materials removed, capped, and treated.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
HILLSIDES				
Revegetate eroding hillsides with areas having less than 50% cover.		3,200 acres		
Revegetate eroding hillsides with areas having less than 50% cover within 50+% cover.		500 acres		
Repair Riparian habitat and stream corridor				at minimum, 100 ft. width
Selected Mine dumps		17 acres or 5 mine dumps		
Gullies identified for remedial actions				12,000 lin.ft.
Terraces completed				42 miles
Terraces in need of repair				160,000 lin.ft.
Proposed new terraces				42,000 lin.ft.
Sediment detention Basin				6 @ 10 ft. deep

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
SMELTERVILLE FLATS				
Contaminated alluvium and jig tailings will be removed for constructed wetland systems and floodway construction.			228 acres	
6" of soils or permanent barrier to cover remaining Jig Tailings/Alluvium mixtures then revegetate.		380 acres		
Collected water wetland treatment	8 cfs		74 acres	
Ground water wetland treatment	3 cfs		34 acres	
Pretreatment pond	8 cfs		36,000 cy	
Revegetate accessible area not otherwise remediated		334 acres		
CENTRAL IMPOUNDMENT AREA (CIA)				
12" of low permeability materials, overlain by a 6" clean soil (including the CIA dikes and surround areas), and vegetate.		280 acres		371,670 cy
Collect and treat seepages from the CIA closure	3 cfs			
Excavate material accumulations in the East cell to the Smelter closure			31,000 cy	

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
Temporary Dust Control		245 acres		
PAGE POND				
Jig tailing accumulations from West Page Swamp will be removed and placed on Page Pond			40-60,000 cy	
Creek channels excavation and revegetation		6 acres	25,000 cy	8,000 ft
Regrade and cap Page Tailing Impoundment with residential yard soils		87,500 cy		
Revegetate after placement of 6" clean soils		40 acres		
Temporary Dust Control.		40 acres		
SMELTER COMPLEX and MINE OPERATIONS AREA (MOA)				
SMELTER COMPLEX				
Temporary dust control measures		NQ		
PCB-containing equipment			88 units	
Asbestos Containing Materials (ACM) to be removed and repaired			NQ	NQ
Debris from demo. of structures/decontaminate salvageable materials	23-225,000 cy			

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
Treat Principal Threat Material accumulations and soils	319,000 cy		319,000 cy	
Channelize and line Government and Bunker Creeks with diversion and treatment of base flows	NQ		80,000 cy	3,500 ft piping
Upper Milo Creek excavation and channelization			20,000 cy	
Cutoff walls will be constructed at upper and lower Government Gulch				14,000 sq.ft.
Government Gulch surface water treatment	1.1 cfs			
Bunker Creek surface water treatment	3.4 cfs			
Government Gulch excavation and channelization			40,000 cy	
Close the mill settling pond		NQ		
Remove and dispose of any sludge remaining in the bottom of the mill settling pond			1,200 cy	
Remove the A-1 Gypsum pond		3.7 acres	115,000 cy	
Remove or cap in place the A-4 Gypsum pond		19 acres	485,000 cy	
Close other existing solid waste landfills		23 acres	94,000 cy	

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
Demolish Zinc Plants and cap and revegetate		53 acres	491,000 sq.ft.	
Demolish Lead Smelter and cap and revegetate		50 acres	400,900 sq.ft.	
Demolish (1) and remove (2) Phosphoric Acid/Fertilizer Plant		20 acres	90,700 sq.ft. (1) 2,700 cy (2)	
Surface waste diversion ditch				2,350 ft.
Additional plant areas revegetation		150 acres		
Leachate collection for closure structures	NQ			
Contaminated materials and soils from the "boneyard area"			44,000 cy	
Some Slag from the west cell of the CIA fill under the final cap			NQ	
Residential soils collected during other remedial actions to facilitate capping and revegetation			NQ	
Material removed within the MOA including the boulevard area during remediation.			NQ	
Magnet Gulch cleanup material accumulations and contaminated soils			NQ	

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
Other materials/soils determined during Remedial Design			NQ	
Plug existing wells				70 wells
Community water tank purchase				NQ
Provide alternate water supplies				28,200 ft.
Vanadium catalyst disposal			78 cy	
Road and staging reclamation				25 acres
Long term pond excavation		1 acre	17,500 cy	
MINE OPERATIONS AREA				
Cleanup material from MOA buildings decontaminated	NQ		NQ	
Surface soils and material accumulations within the MOA	22,000 cy			
Remove high levels of contamination materials consistent with future land use			NQ	
A minimum of 6" of clean soil or other appropriate barrier will be applied where surface concentrations exceed 1000 ppm lead.			NQ	

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]
Pre-treatment of acid mine drainage in the CTP	3-4 cfs			
RIGHTS-OF-WAY (ROW)				
Capping in the Non-populated Areas		NQ		
Removal and replacement in the Smelter Complex and the MOA			NQ	
Temporary dust control measures		NQ		
COMMERCIAL BUILDINGS AND LOTS				
Protective barrier (6" clean soils or gravel, or a paved surface; 12" soil for sensitive area) on surface soils exceeding 1000 ppm lead		30-60 acres		
Material excavated during commercial development			20-80,000 cy	
RESIDENTIAL INTERIORS				
All home with house dust lead concentrations greater than or equal to 1000 ppm lead will have one time cleaning				1,550 homes

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

Table 9-2

Estimated Quantities Area-Specific Remedial Actions for Selected Remedy

AREA/SUBAREA DESCRIPTIONS	ESTIMATED QUANTITIES PERTAINING TO TYPES OF REMEDY			
	TREAT OR RECYCLE/ REPROCESS	CONTAINMENT[a]	REMOVAL[b] TO OFF-/ONSITE CLOSURES	OTHER[c]

Source: Bunker Hill Superfund Site Feasibility Study Report, Volumes I, II, III (Appendices B, E, and K), Executive Summary, and Technical Memoranda.

a Containment includes: barriers, revegetation, caps, ...
b To be placed in closure cell.
c Other includes: repair, regrade, diversions, interior house cleaning, ...

Note: Columns are not additive, some numbers are listed more than once. For example the 3 cfs from the CIA seeps will be part of the 8 cfs treated in the collected water wetland.

NQ [=] Not quantified

Due to the complexity of the remedial actions and the fact that many remedial actions are difficult to include in the above categories, the numbers reported here are intended only for general information.

9.5 COST

Cost evaluations, including the assumptions used, are presented in the Non-populated Areas Feasibility Study (FS) report. A summary of estimated capital, both direct and indirect, and O&M, and net present worth costs associated with the selected remedy is outlined in Table 9-3. Contingency allowances have been included in the estimates, consistent with the extent of the uncertainties. The accuracy of the estimates is expected to fall within the acceptable range of +50 percent to -30 percent, as outlined in the NCP.

Capital costs are those required to initiate and construct the remedial action. Typical capital costs include construction equipment, labor, and material expenditures, engineering, and construction management. The total estimated capital, including direct and indirect costs, is $56.6 million (Table 9-3).

An implementation period of six years for the selected remedy was assumed for cost estimation purposes. The exact duration of initial implementation and corresponding capital cost distribution is dependent on the results of the Remedial Design Phase. The capital cost for each year is converted to 1991 dollars. Using a three, five, and ten percent discount rates and a 30-year estimated project life, the present worth cost for the selected remedy is $57.2, $52.0, and $42.4 million, respectively (Table 9-3). Capital costs and long-term annual O&M costs are included in the total present worth cost.

Estimates for the cost of O&M activities are prepared for operations expected to be performed for the 30-year period following site remediation. Site wide monitoring costs, a contingency fund for unpredicted events, and allowance for periodic site reviews are not included. These costs are necessary to ensure the continued effectiveness of the remedial action.

The feasibility study cost estimates have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented here.

The cost estimates as presented in the FS do not include costs for the Hillside work that is required by a 1990 Hillsides AOC or additional cost of revegetation in the 50 - 85% cover class. The costs for commercial buildings and lots, rights-of-way, interior dust remediations, and compliance with National Historic Preservation Act were also not estimated. However, the cost estimate does include the cost of demolishing the two tall stacks which is not a required component of this ROD and the solidification of the copper dross flue dust (CDFD) which has already been relocated to the Lead Smelter in preparation for stabilization as required by a 1991 UAO issued by the U.S. EPA.

In addition to the costs specified in this ROD, site wide cleanup also includes an estimated $40 million dollars to implement the Residential Soils Record of Decision, and approximately $20

Table 9-3
Summary of Estimated Costs for Selected Remedy

ITEM	CAPITAL COST ($)	ANNUAL O&M COST ($)
COLLECTED WATER WETLAND		
Excavation and Construction Work	2,344,558	
Coarse & Fine Gravel (onsite and offsite)	1,899,005	
Purchase and Place Liner	2,092,974	
Place Gravel	501,424	
Hydraulic Controls	11,385	
Bunker and Government Creek Piping	70,000	
Sumps and Controls	6,325	
Pretreatment Pond	194,760	
Haul Road Upgrades	63,250	
Revegetation and Fencing	337,116	
Subtotal	$ 7,520,796	$ 1,612,000
SFCDR CHANNEL ENHANCEMENT		
Excavation	2,005,330	
Levee Construction and Riprap	1,801,270	
Revegetation	49,145	
Subtotal	$ 3,855,745	$ 335,000
GROUND WATER WETLAND		
Excavation and Construction Work	2,374,054	
Coarse and Fine Gravel	552,336	
Place Gravel	230,384	
Hydraulic Controls	2,530	
Road Upgrades	31,625	
Revegetation and Fencing	150,538	
Subtotal	$ 3,341,467	$ 961,000
ENHANCED WETLAND	$ 316,250	$ 116,000
SMELTERVILLE FLATS REVEGETATION	$ 1,628,470	$ 704,000
PAGE SWAMP JIG TAILINGS REMOVAL/WETLAND IMPROVEMENT		
Excavation	608,044	
Channels Revegetation	10,816	
Outlet Controls	2,530	
PWTP Outlet Diversion	18,360	
Subtotal	$ 639,750	$ 178,000 [a]

Table 9-3
Summary of Estimated Costs for Selected Remedy

ITEM	CAPITAL COST ($)	ANNUAL O&M COST ($)
HUMBOLDT AND GROUSE CREEKS CHANNELIZATION	$ 60,000	
PAGE POND CAP (Spreading & Revegetation)	$ 223,775	
CIA TAILINGS CLOSURE (East Cell)		
Excavate Plant Wastes for Repository	388,355	
Grades Slopes	557,700	
Clay Cap Excavation and Placement	1,575,662	
Purchase and Spread Topsoil	2,819,455	
Access Roads	273,564	
Revegetate	322,575	
Haul Road Upgrades	31,625	
Subtotal	$ 5,968,936	
GYPSUM A-5 POND CLOSURE (Middle Cell)		
Cut Drains	123,057	
Plug Drains	22,342	
Pipe to CTP	54,000	
Grade Slopes	400,067	
Clay Cap Excavation and Placement	695,145	
Purchase and Spread Topsoil	1,243,880	
Revegetate	142,313	
Haul Road Upgrades	12,650	
Subtotal	$ 2,693,454	
CIA SEEP COLLECTION		
Trench Construct w/ Gravel Placement	253,000	
Piping	140,000	
Subtotal	$ 393,000	$ 795,000 [h]
LEAD SMELTER DEMOLITION AND CAP		
Demolish Buildings and Stacks	1,402,340	
Construct Soil Cover	720,000	
Topsoil Purchase and Placement	828,568	
Revegetation	94,880	
Surface Water Diversion Ditch	115,950	
Fencing	75,900	
Subtotal	$ 3,237,638	$ 633,000

Table 9-3
Summary of Estimated Costs for Selected Remedy

ITEM	CAPITAL COST ($)	ANNUAL O&M COST ($)
ZINC PLANT DEMOLITION AND CAP		
Demolish Buildings and Stacks	1,723,900	
Construct Soil Cover	302,000	
Topsoil Purchase and Placement	878,940	
Revegetation	100,570	
Surface Water Diversion Ditch	65,510	
Fencing	50,600	
Subtotal	$ 3,121,520	$ 588,000
PHOSPHORIC ACID/FERTILIZER PLANT DEMOLITION AND REMOVAL		
Demolish Buildings	200,880	
Remove Foundations	170,800	
Topsoil Purchase and Replacement	331,633	
Revegetation	37,950	
Subtotal	$ 741,263	
MATERIALS REMOVAL AND TREATMENT		
Copper Dross Flue Dust	1,200,000	
Acid Tank Bottom Sludge	60,000	
Other Wastes	1,320,000	
Subtotal	$ 2,580,000	
HAUL ACCUMULATED MATERIAL TO SMELTER CLOSURE AREA	$ 2,087,250	
IMPOUNDMENTS CLOSURE	$ 109,994	
INDUSTRIAL LANDFILL CAP		
Earthworks	891,120	
Monitoring Wells	150,875	
Revegetation	43,643	
Subtotal	$ 1,085,638	$ 907,000 [c]
CAP A-4 GYPSUM POND		
Construct Cap (onsite materials)	93,620	
Purchase and Spread Topsoil	318,680	
Revegetation	36,053	
Subtotal	$ 448,353	$ 330,000

Table 9-3
Summary of Estimated Costs for Selected Remedy

ITEM	CAPITAL COST ($)	ANNUAL O&M COST ($)
A-1 GYPSUM POND		
Excavate and Haul to Middle Cell	437,000	
Revegetation	7,021	
subtotal	$ 444,021	$ 60,000
ADDITIONAL PLANT AREAS REVEGETATION	$ 284,625	$ 71,000
GOVERNMENT GULCH CHANNELIZATION		
Excavation	57,200	
Erosion Protection	240,000	
Cutoff Walls	88,200	
Subtotal	$ 385,400	$ 527,000 [d]
UPPER MILO CREEK CHANNELIZATION		
Excavation	28,600	
Erosion Protection	120,000	
Subtotal	$ 148,600	
EXISTING WELL PLUGGING	$ 182,000	
COMMUNITY WATER TANK PURCHASE	$ 225,000	
PROVIDE ALTERNATIVE WATER SUPPLIES	$ 348,930	
CLEAN MINE OPERATION BUILDINGS	$ 437,778	
CIA WEST CELL REGRADING		
Grade Slopes	70,417	
Clay Cap Excavation and Placement	157,566	
Purchase and Spread Topsoil	281,939	
Revegetate	32,258	
Subtotal	$ 542,180	
VANADIUM CATALYST DISPOSAL	$ 15,600	
LONG TERM POND		
Excavation	77,525	
Liner Purchase	30,240	
Fencing	10,753	
Subtotal	$ 118,518	$ 281,000
ROAD AND STAGING AREA RECLAMATION	$ 47,438	
PCB DISPOSAL	$ 1,509,344	

Table 9-3
Summary of Estimated Costs for Selected Remedy

ITEM	CAPITAL COST ($)	ANNUAL O&M COST ($)
HEALTH AND SAFETY		
Worker Costs	797,160	
H&S Staff	676,775	
Air Monitoring	632,500	
Supplies and Support	442,750	
Subtotal	$ 2,549,185	

COSTS SUMMARY	TOTAL COSTS	TOTAL O&M COSTS
TOTAL DIRECT COST	$47,293,000	
ENGINEERING	$ 4,550,000	
CONTINGENCY	$ 4,729,000	
TOTAL INDIRECT COSTS	$ 9,279,000	
TOTAL COSTS	$56,571,000	$11,096,000
GRAND TOTAL	$67,667,000	
TOTAL PRESENT WORTH (3% Discount Rate)	$50,556,000	$ 6,676,000
TOTAL PRESENT WORTH (5% Discount Rate)	$47,049,000	$ 4,986,000
TOTAL PRESENT WORTH (10% Discount Rate)	$39,694,000	$ 2,727,000

(a) O&M costs for the Page Pond areas.
(b) O&M costs for the CIA areas.
(c) O&M costs for both Governmental Gulch channelization and Government/Bunker Creek Water Collection.
(d) O&M costs for both Industrial Landfill and High Level Repository.

Notes:
1. All costs reported in constant 1991 U.S. Dollars. These costs do not include costs for work performed to date in the Non-populated Areas in response to U.S. EPA Administrative Orders (i.e., Hillside work, revegetation in 50-80% cover class, commercial buildings and lots, ROWs, and interior dust remediation, and cost associated with compliance to the National Historic Preservation Act), nor do they include costs for any past, present, or future work performed to remediate residential yards. However the tall stack demolition is included in the total cost column and is expected to account for some of these costs.
2. All present worth values are negative.
3. O&M costs include the estimated costs of institutional controls and monitoring in the Non-populated Areas.

million dollars which has been incurred to date for site investigations, removal actions, and oversight of PRP investigations and response actions. To date, approximately 400 residential properties have been remediated and numerous response action have been taken across the Site to protect human health and the environment. These actions are discussed in Section 2 of this ROD.

It is anticipated that although cost estimates presented in the FS and summarized in this ROD do not include a specific itemization of every item of the selected remedial action, as noted above, these omissions are offset by inclusion of other elements in the FS cost estimates that are currently being addressed under U.S. EPA Orders. In any case, the overall cost estimate is expected to be consistent with RI/FS Guidance (U.S. EPA 1988).

9.6 PERFORMANCE REQUIREMENTS

Performance requirements for specific remedial actions are included in Section 9.2 of this ROD, Remedial Actions by Subarea. During remedial design, monitoring programs will be developed to evaluate performance of each remedial action. Additionally, O & M requirements will provide for continued achievement of performance standards over time.

10 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, will comply with federal and state requirements that are legally applicable or relevant and appropriate (unless the contingent waiver discussed in Section 10.2 of this ROD is invoked), and is cost-effective. The selected remedy utilizes alternative treatment and resource recovery technologies to the maximum extent practicable. Because this remedy will result in hazardous substances remaining onsite above health-based levels, the five-year review provisions of Section 121(c) of CERCLA, 42 U.S.C. §9621(c), will apply to this action. The following sections discuss how the selected remedy meets the statutory requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The remedy selected is protective of human health and the environment by inhibiting the significant exposure pathways through removals, containment, and treatment. The transport of contaminants by air and direct exposure to contaminated soils will be controlled by removal of contaminated materials or barriers. Base flow surface water from contaminated onsite tributaries entering the SFCDR will be treated prior to entering the river. Revegetation and erosion control efforts on the hillsides will help control the transport of soils by surface water runoff during storm events. A portion of the ground water that enters the SFCDR in the vicinity of Pinehurst Narrows and the CIA seeps will be collected and treated prior to entering the river, as will the ground water in the Government Gulch. Infiltration through the Smelter Complex and CIA caps will be minimized by implementation of effective closure methods, therefore the impact to ground water from these areas will be reduced. Principal Threat soils and source materials will be treated prior to consolidation within the Lead Smelter closure. This will effectively limit the potential of a release of Principal Threat material if the cap is ever breached.

The analysis presented in the FS demonstrates that the remedy selected will reduce the significant exposure pathways. When the remedial actions are completed and the Institutional Controls Program is implemented, the risks associated with metal contamination will be reduced to acceptable levels. Therefore, U.S. EPA has concluded that the selected remedy will be protective of human health and the environment.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Pursuant to Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), remedial actions shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and control of further release which, at a minimum, assures protection of human health and the environment. In addition, remedial actions shall, upon their completion, reach a level or standard of control for such hazardous substances, pollutants, or contaminants which at least attains legally applicable or relevant and appropriate federal standards, requirements, criteria, or limitations, or any promulgated standards, requirements, criteria, or limitations under a state environmental or facility siting law that is more stringent than any federal standard (ARARs). In instances where the remedial actions do not achieve ARARs the basis for a waiver must be provided by U.S. EPA.

The federal and state ARARs for this remedy, identified by U.S. EPA and IDHW, respectively, are presented in Tables 10-1 through 10-6. These tables cite the requirements identified, state whether the requirements are applicable or relevant and appropriate, summarize the substantive standards to be met, and specify where in this ROD the requirements must be met. It is expected that this remedy will satisfy all ARARs identified, except in the instance where the contingencies outlined below for attainment of groundwater ARARs in the main valley aquifer demonstrate the technical impracticability of achieving chemical-specific ARARs for certain areas of the aquifer. Because of the complexity of this remedy, the applicability of certain of the ARARs is discussed below. Additional analyses of ARARs is presented in Section 8 of the Non-populated Feasibility Study and Section 2 of the Residential Soils Feasibility Study.

Ground and Surface Water ARARs

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), specifically states that remedial actions shall attain a level or standard of control established under the Safe Drinking Water Act (SDWA), where such level or control is applicable or relevant and appropriate to any hazardous substance, pollutant or contaminant that will remain onsite. The enforceable standards under the SDWA are maximum contaminant levels (MCLs) which represent the maximum permissible level of a contaminant which may be delivered to any user of a public water system. Section 121(d) of CERCLA also states that remedial actions shall attain maximum contaminant level goals (MCLGs) where such goals are relevant and appropriate. (MCLGs are health-based goals set at levels at which no adverse health effects may arise, with a margin of safety.)

MCLs are only legally applicable under the SDWA to the quality of drinking water at the tap. Therefore, MCLs are not applicable with regard to remediation of surface or ground water which is not used or intended for drinking water purposes. They are, therefore, not applicable standards with regard to this remedy. In addition, because the riparian surface water onsite is classified by the State for agricultural and non-contact recreational purposes, and not drinking water, MCLs and MCLGs are not relevant and appropriate for remediation of onsite, riparian surface waters. However, MCLs and MCLGs are relevant and appropriate for ground water onsite since it is possible that the aquifer could be used for drinking water purposes in the future.

One goal of site-wide remedial actions is to restore ground water to its maximum beneficial use. Currently, onsite ground water is utilized for domestic consumption only in limited circumstances and primarily in areas outside of the contaminated valley aquifer system. Public water supplies within the Site come from surface water sources that are unimpacted by Site contamination. While domestic use of ground water is limited, there are some wells within the valley aquifer system operated by individuals utilizing ground water for landscaping or other non-consumptive purposes.

Remedial actions specified in this ROD will limit exposure to contaminated ground water by abandoning potentially contaminated wells and connecting additional users to the public water supply system. These actions, in conjunction with the use of institutional controls to limit future utilization of contaminated ground water, provide adequate protection of human health from this exposure pathway.

Notwithstanding the effectiveness of these actions in minimizing exposure of the resident population to contaminated ground water, it is also a goal of this remedial action to improve ground water quality, both for potential use as a water supply, and to ensure that it does not contribute to surface water quality degradation.

Based on information obtained during the Remedial Investigation, and the analysis of remedial alternatives, U.S. EPA and IDHW believe that the selected remedy may be able to achieve the water quality improvement objectives stated above. However, ultimate attainment of federal Drinking Water Standards in the valley aquifer system will in part depend upon the success of upstream water quality improvement initiatives in controlling contaminant loading to the valley aquifer system, as well as onsite actions. Ground water contamination may be especially persistent in the immediate vicinity of contaminant sources, and in portions of the valley aquifer system most strongly influenced by upgradient surface and ground water contamination.

The ability to achieve cleanup goals (DWS ARARs and protection of surface water quality) at all points throughout the valley aquifer system cannot be determined until the remedial actions outlined in this ROD have been effective in meeting their individual performance standards (specified in Section 9), and upgradient efforts to improve water quality have been implemented. If the selected remedy cannot meet DWS throughout the valley aquifer system, notwithstanding upgradient efforts that may be implemented independently of the actions required by this ROD, to improve ground water quality entering the Site, the contingency measures described in this section may replace the selected remedy and ground water cleanup goals. These contingency measures will include refinement of ground water recovery and treatment system components of the remedial action, and continuation of institutional controls.

The selected remedy will include ground water extraction and treatment from the western portion of Smelterville Flats, areas North of the CIA, and Government Gulch for an estimated period of no less than 10 years after the completion of site wide source control remedial actions. Overall system performance will be carefully monitored on a ongoing basis and adjusted as warranted to maximize system efficiency. Modifications may include any or all of the following:

a. augmentation of passive ground water collection at the Smelterville Flats ground water wetland by active recovery of ground water (i.e., pumping) to increase capture efficiency if RAOs for protection of SFCDR water quality due to onsite sources are not met due to ground water contributions to this segment of the river;

b. modifications to the ground water (seep) collection system to be constructed north of the CIA to increase contaminated ground water capture efficiency if RAOs for protection of SFCDR water quality due to onsite sources are not met due to ground water contributions to this segment of the river;

c. active collection and treatment of contaminated ground water in Deadwood Gulch and Magnet Gulch if source control measures in those areas are not successful in controlling the continued release of contaminants of concern to the ground water system at concentrations exceeding ARARs

d. removal, containment, or treatment of discrete ground water contaminant sources when it can be determined that additional benefits to ground water may be achieved by such actions.

If it is determined, based on the successful implementation of the selected remedy (i.e., performance standards are met), and the above specified modifications, that certain areas of the valley aquifer system cannot be expected to meet ARARs, notwithstanding whatever additional efforts which may be made, independently of the actions required by this ROD to improve upgradient ground water quality entering the Site, the following measures involving long-term management may occur, for an indefinite period of time, as a modification to the existing system:

a. a long-term program will be developed and funded to insure the continued operation of containment systems, (such as source control measures and ground water recovery and treatment components of the remedial actions) to limit the continued release or migration of contaminants of concern;

b. chemical-specific ARARs will be waived for those limited portions of the valley aquifer system not meeting drinking water ARARs, based upon the technical impracticability of achieving further contaminant reductions, as demonstrated by implementation of the selected remedy and the modifications discussed above;

c. institutional controls will be continued to restrict access to those portions of the aquifer which remain above remediation goals;

d. monitoring of ground water to evaluate changes in ground water quality and insure the adequacy of institutional controls in limiting exposure to contaminated ground water;

e. periodic review will be performed of the success of upgradient water quality improvement initiatives in enhancing onsite water quality; long-term improvements may influence the requirements of the institutional control system.

The decision to invoke any or all of these measures will occur during periodic reviews of the remedial action, which will occur at least every 5 years, in accordance with CERCLA section 121(c) of CERCLA, 42 U.S.C. § 9621(c).

U.S. EPA has determined that the human health water quality criteria for ingestion of organisms (fish) and the chronic aquatic life water quality criteria (FWQCs) under the Clean Water Act are applicable with regard to onsite tributaries to the SFCDR. With respect to the SFCDR, the RI demonstrates that SFCDR water quality within the Site is substantially controlled by loadings from sources upstream of the Site to a degree that even with total elimination of loadings from onsite sources, the FWQC for cadmium, lead, and zinc would still be exceeded (See Section 5.2 of the Technical Memorandum: Post Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4). Because this ROD does not address remediation of the SFCDR (except for the contribution from onsite sources), attainment of FWQC in the SFCDR is not an ARAR with respect to this remedial action.

Currently the SFCDR is a water quality limited stream segment; however, IDHW, U.S. EPA, the Coeur d'Alene Tribe, and other interested state federal and local agencies are considering development of a Total Maximum Daily Load (TMDL) for the SFCDR, as required by the Clean Water Act. Discharge limits for the Collected Water Wetland and Ground Water Wetland treatment systems effluents will be determined as this process evolves as part of the Coeur d'Alene Basin Restoration Project. It is also expected that control and abatement of onsite sources of contaminants will be effective in reducing metal loading to both ground and surface water.

Five year reviews, at a minimum, will be relied upon to evaluate the effectiveness of the selected remedy and compliance with ARARs. In addition, until the ARARs can be met, the remedy will rely on the institutional control of water use to be adequately protective of human health.

RCRA ARARs

RCRA imposes a number of requirements on remediation involving the disposal and/or placement of wastes and therefore contains a number of provisions which may be ARAR at a Site. Land Disposal Restrictions (LDRs) place specific restrictions on certain RCRA hazardous wastes prior to their placement in a land disposal unit. Under CERCLA, placement occurs when wastes are moved from one "area of contamination" (AOC) to another. Therefore, wastes left in place or consolidated within one AOC are not subject to the regulations. For purposes of this ROD, the entire Bunker Hill Site has been identified as one AOC. LDRs, therefore, are generally not applicable. In addition, certain wastes produced through the extraction and beneficiation of minerals (and some specifically identified mineral processing wastes) have been excluded from RCRA regulation pursuant to section 3001(b)(3)(A)(ii) of RCRA, 42 U.S.C. § 6901(b)(3)(A)(ii) (these excluded wastes are referred to as "Bevill-exempt"). Further, LDR treatment standards have not been promulgated for mineral processing wastes. Although LDRs are not applicable to any of the actions specified in this ROD, U.S. EPA has determined that certain aspects of RCRA LDRs may be relevant and appropriate for the treatment of Principal Threat soil and material accumulations. As was discussed previously, the relevant and appropriate aspects of LDRs for treatment of Principal Threat waste will be attained through design of a cement-based stabilization mixture that will meet percent reduction goals and/or extract concentration criteria outlined in the RCRA LDRs for inorganic materials using a rain water leach test to simulate onsite conditions. Those percent reduction standards are a minimum of; 90% for arsenic, 90% for mercury; 95% for cadmium, 90% for antimony, 95% for nickel, and 99% for lead. Extraction concentration criteria are 1.0 ppm for arsenic, 0.008 ppm for mercury, 2.0 ppm for cadmium, 0.2 ppm for antimony, 1.0 ppm for nickel, and 3.0 ppm for lead.

RCRA LDRs are not applicable or relevant and appropriate at the Page Pond, CIA, Hillside, mine dump, or Smelterville Flats portions of the Site because wastes in these areas are Bevill-exempt and/or their placement constitutes consolidation within the AOC. While not applicable at the MOA, LDRs are relevant and appropriate there for wastes which will be treated. Finally, LDRs are not applicable or relevant and appropriate at the Wetlands System because wastes there are being consolidated for in situ treatment.

In addition to LDRs, RCRA can impose closure (40 CFR Part 264, Subpart G) and ground water monitoring requirements (40 CFR Part 264 Subpart F). For purposes of this ROD, RCRA 40 CFR Part 264, Subpart G closure requirements are relevant and appropriate to the Smelter Complex. With regard to potential wastes which may remain onsite as treatment residuals at the Wetland Systems, relevant and appropriate aspects of RCRA 40 CFR Part 264, Subpart X will apply. At these areas of the Site, RCRA's substantive closure requirements will be met. In addition, certain provisions of RCRA 40 CFR Part 264, Subpart G are relevant and appropriate at the CIA and Page Pond. Compliance with the substantive requirements for protectiveness under these sections will be achieved through capping and institutional controls as further described in Section 9.2 of this document.

Requirements for ground water monitoring under RCRA 40 CFR Part 264, Subpart F are relevant and appropriate for RCRA wastes located at the Smelter Complex and the Wetlands System. Although not applicable based on Bevill-exempt status, RCRA 40 CFR Part 264, Subpart F requirements are relevant and appropriate at the Smelterville Flats, Page Pond, CIA, MOA, and Hillside portions of the Site. The substantive requirements for ground water monitoring will be achieved under the Site wide monitoring program established for the overall remedy.

Asbestos and PCB ARARs

The substantive standards of 40 CFR § 61 regarding management and disposal of asbestos and 40 CFR § 700 regarding PCB management and disposal are applicable at the Smelter Complex and MOA portions of the Site. Before and during demolition, asbestos and PCB containing materials will be properly managed pursuant to these regulations. Asbestos management during remedial actions will also be consistent with U.S. EPA's policy regarding disposal onsite.

Executive Orders

Executive Order 11990, 40 CFR Part 6, Appendix A, regarding wetlands protection is applicable for the West Page Swamp remedial actions and certain portions of the Smelterville Flats area. These areas will be managed to avoid adverse effects, to minimize harm, and, to the extent practicable, to enhance wetlands in keeping with this Executive Order. In addition, Executive Order 11988, 40 CFR Part 6, Appendix A regarding floodplain protection is applicable at the West Page Swamp, Smelterville Flats, and Wetlands System portions of the Site. Pursuant to the terms of this Executive Order, these areas will be evaluated for potential effects from flood hazards.

Table 10-1
Federal Chemical-Specific ARARs

Chemical-Specific	Citation	Prerequisite	Requirement	Location
I. Air				
A. Applicable Requirement				
1. Clean Air Act National Ambient Air Quality Standards (NAAQS)	42 U.S.C. Section 7401 et seq; 40 CFR Part 50	Establishes ambient air quality standards for emissions of chemicals and particulate matter.	Emissions of particulates and chemicals which occur during remedial activities will meet the applicable NAAQS which are as follows. Particulate Matter: 150 $\mu g/m^3$ 24-hour average concentration, 50 $\mu g/m^3$ annual arithmetic mean. Lead: 1.5 μg Pb/m^3 (.5 μg Pb/m^3 is proposed)	Site Wide
B. Relevant and Appropriate Requirement	None			
C. To Be Considered Materials	None			
II. Soil and Dust				
A. Applicable Requirements	None			
B. Relevant and Appropriate Requirement	None			

Table 10-1
Federal Chemical-Specific ARARs

Chemical-Specific	Citation	Prerequisite	Requirement	Location
C. To Be Considered Materials				
1. Risk Assessment Data Evaluation Report (RADER) for the Non-populated Areas of the Bunker Hill Superfund Site	Technical Enforcement Contract Work Assignment C10002 Prepared by: Jacobs Engineering Group, Inc. and TerraGraphics, Inc.	Evaluates baseline health risk due to current site exposures and establishes contaminant levels in environmental media at the Site for the protection of public health.	The ARARs for soils may not provide adequate protection to human health; therefore a risk assessment approach using these guidances should be used in determining cleanup levels.	Site Wide
2. Soil/Dust Lead Contamination Advisory	Centers for Disease Control's statement on childhood blood lead levels, 1985.	Removal of contaminated soils.	Lead in soil/dust appears to be responsible for blood lead levels in children increasing above background levels when the concentrations in the soil/dust exceed 500-1,000 ppm. This concentration is based upon the established CDC blood lead level of 25 μg Pb/dl in children. When soil/dust lead concentrations exceed 500-1,000 ppm, blood lead levels in children are found to exceed 25 μg Pb/dl.	Site Wide

Table 10-1 Federal Chemical-Specific ARARs				
Chemical-Specific	Citation	Prerequisite	Requirement	Location
3. U.S. EPA Interim Guidance Concerning Soil Lead Cleanup Levels at Superfund Sites	Office of Solid Waste and Emergency Response (OSWER) Directive #9355.4-02, September 1989	Establishes an interim soil cleanup level for total lead in residential settings.	This guidance adopts the recommendation contained in the 1985 CDC statement on childhood lead poisoning (an interim soil cleanup level for residential settings of 500-1,000 ppm total lead), and is to be followed when the current or predicted land use of contaminated areas is residential.	Site Wide
4. U.S. EPA Strategy for Reducing Lead Exposures	Environmental Protection Agency October 31, 1990	Presents a strategy to reduce lead exposure, particularly to young children.	The strategy was developed to reduce lead exposures to the greatest extent possible. Goals of the strategy are to: 1) significantly reduce blood lead incidence above 10 μg Pb/dl in children; and 2) reduce the amount of lead introduced into the environment.	Site Wide

Table 10-1
Federal Chemical-Specific ARARs

Chemical-Specific	Citation	Prerequisite	Requirement	Location
III. Ground Water				
A. Applicable Requirement	None			
B. Relevant and Appropriate Requirement	Safe Drinking Water Act 40 CFR §141	MCLs, MCLGs, for arsenic, copper, lead, mercury, PCBs, selenium, silver, zinc, and nitrate	Maximum permissible level of contaminant which may be delivered to user of public water system	Site Wide
C. To Be Considered	None			
IV. Surface Water				
A. Applicable Requirement	Clean Water Act - FWQC 40 CFR	Establishes acceptable contaminant levels for ingestion of aquatic organisms and for intake by aquatic organisms in surface water	FWQC for antimony, arsenic, beryllium, cadmium, copper, lead, zinc, mercury, and PCBs	Onsite source contributions only and SFCDR tributaries onsite
B. Relevant and Appropriate Requirement				
1. CWA-NPDES 40 CFR §440		Discharges to waters of U.S. must meet standards established under NPDES program.	Treatment of water to meet new permit requirements.	Onsite surface, water services, CIA, wetland system.
C. To Be Considered	None			
V. Debris/Buildings				

Table 10-1
Federal Chemical-Specific ARARs

Chemical-Specific	Citation	Prerequisite	Requirement	Location
A. Applicable Requirement	Toxic Substance Control Act 40 CFR §761, Subpart G	Establishes a PCB spill policy and regulates PCBs at concentrations of 50 ppm or greater, procedures for storage and disposal of PCBs, and PCB-containing materials.	PCB contaminated material must be managed and disposed of at TSCA facilities.	Smelter Complex and MOA
	40 CFR §61	Establishes regulations governing management and disposal of asbestos.	Asbestos must be removed, managed, and disposed in accordance with specified standards.	Smelter Complex and MOA
B. Relevant and Appropriate Requirement	None			
C. To Be Considered	"A Guide on Remedial Actions at Superfund Sites with PCB Contamination" U.S. EPA Directive 9355.4-01 FS	Establishes guidelines for management and remediation of PCB/PCB contaminated material.		Smelter Complex and MOA

Table 10-2
Federal Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
I. Federal				
A. Applicable Requirement				
1. Historic project owned or controlled by a Federal Agency	National Historic Preservation Act; 16 U.S.C. 470 et seq; 40 CFR 6.301(b); 36 CFR Part 800.	Property within areas of the Site is included in or eligible for the National Register of Historic Places.	The remedial action will be designed to minimize the effect on historic landmarks.	Site Wide
2. Site within an area where action may cause irreparable harm, loss, or destruction of artifacts.	Archeological and Historic Preservation Act; 16 U.S.C. 469; 40 CFR 6.301(c).	Property within area of the Site contains historical and archeological data.	The remedial action will be designed to minimize the effect on historical and archeological data.	Site Wide
3. Site located in area of critical habitat upon which endangered or threatened species depend.	Endangered Species Act of 1973; 16 U.S.C. 1531-1543; 50 CFR Parts 17, 401; 40 CFR 6.302(b). Federal Migratory Bird Act; 16 U.S.C. 703-712.	Determination of presence of endangered or threatened species.	The remedial action will be designed to conserve endangered or threatened species an their habitat, including consultation with the Department of Interior if such areas are affected.	Site Wide

Table 10-2
Federal Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
4. Site located within a floodplain	Protection of Floodplains, Executive Order 11988; 40 CFR 6, Appendix A.	Remedial action will take place within a 100-year floodplain.	The remedial action will be designed to avoid adversely impacting the floodplain wherever possible to ensure that the action's planning and budget reflects consideration of the flood hazards and floodplain management.	West Page Swamp, Smelterville Flats, and Wetlands System
5. Wetlands located in and around the site.	Protection of Wetlands; Executive Order 11990; 40 CFR 6, Appendix A.	Remedial actions may affect wetlands.	The remedial action will be designed to avoid adversely impacting wetlands wherever possible, including minimizing wetlands destruction and preserving wetland values.	West Page Swamp and Smelterville Flats
5a. Structures in waterways	Rivers Harbors Act 33 CFR §320-330	Placement of structures in waterways is restricted to pre-approval of Corps of Engineers	The remedial action will comply with these requirements.	Site Wide

Table 10-2
Federal Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
6. Waters in and around the Site.	Clean Water Act (Section 404)- Dredge or Fill Requirements; 33 U.S.C. 1251-1376; 40 CFR 230, 231	Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredged or fill material.	The four conditions that must be satisfied before dredge and fill is an allowable alternative are: - There must be no practical alternative. - Discharge of dredged or fill material must not cause a violation of State water quality standards, violate any applicable toxic effluent standards, jeopardize threatened or endangered species, or injure a marine sanctuary.	Site Wide

Table 10-2
Federal Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
6. Waters in and around the Site. (Continued)			- No discharge shall be permitted that will cause or contribute to significant degradation of the water. - Appropriate steps to minimize adverse effects must be taken. Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.	
7. Area containing fish and wildlife habitat.	Fish and Wildlife Conservation Act of 1980; 16 U.S.C. 2901; 50 CFR Part 83. Fish and Wildlife Conservation Act, 16 U.S.C. §661 et seq. Federal Migratory Bird Act, 16 U.S.C. 703	Activity affecting wildlife and non-game fish.	Remedial action will conserve and promote conservation of non-game fish and wildlife and their habitats.	Site Wide

Table 10-2
Federal Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
B. Relevant and Appropriate Requirement	None			
1. 100-year floodplain.	Location Standard for Hazardous Waste Facilities - RCRA; 42 U.S.C. 6901; 40 CFR 264.18(b).	RCRA hazardous waste treatment and disposal.	Facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout during any 100-year/24 hour flood.	Site Wide
C. To Be Considered	None			

Table 10-3 Federal Action-Specific ARARs				
Action-Specific	Citation	Prerequisite	Requirement	Location
A. Applicable Requirement				
1. Disposal of Solid Waste	RCRA 42 U.S.C. §6901 et seq; 40 CFR 257	Maintenance of a facility at which solid wastes are disposed of.	- Facility or practices in floodplains will not restrict flow of basic flood, reduce the temporary water storage capacity of the floodplain or otherwise result in a wash-out of solid waste. - Facility or practices shall not cause or contribute to taking of any endangered or threatened species. - Facility or practices shall not result in the destruction or abuse of critical habitat.	CIA, Page Pond, and solid waste landfills

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
1. Disposal of Solid Waste (Continued)			- Facility or practices shall not cause discharge of pollutants into waters of the U.S. in violation of a NPDES permit. - Facility or practices shall not cause discharge of dredged or fill material into waters of the U.S. - Facility or practices shall not contaminate underground drinking source beyond facilities boundary.	CIA, Page Pond, and solid waste landfills

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
1. Disposal of Solid Waste (Continued)			- The concentration of explosive gases generated at the facility shall not exceed: (1) 25% of the lower explosive limit for the gases in facility structures; (2) the lower explosive limit for the gases at the boundary. - Facility or practices shall not pose a hazard to the safety of persons or property from fire. - Facility or practices shall not allow uncontrolled public access so as to expose the public to potential health and safety hazards.	CIA, Page Pond, and solid waste landfills

Table 10-3 Federal Action-Specific ARARs				
Action-Specific	Citation	Prerequisite	Requirement	Location
B. Relevant and Appropriate Requirement				
1. Removal of contaminated soils	Surface Mining Control and Reclamation Act of 1977; 25 U.S.C. §§1201 et seq; 30 CFR Parts 816.11, .95, .97, .100, .102, .107, .111, .113, .114, .116	Removal of contaminated soils.	.11-Posting signs and markers for reclamation, including top soil markers and perimeter markers. .95-Stabilization of all exposed surface areas to effectively control erosion pollution attendant to erosion. .97-Use of best technology currently available to minimize disturbance, adverse impacts on fish, wildlife, related environmental values and enhancement of such if possible; no activity which would jeopardize continued existence of endangered or likely destroy or adversely effect critical habitat; avoid habitat disturbance & enhance where practicable, restore, replace, wetlands, riparian vegetation habitats for fish and wildlife.	Site Wide

Table 10-3 Federal Action-Specific ARARs				
Action-Specific	Citation	Prerequisite	Requirement	Location
1. Removal of contaminated soils (Continued)			.100-Contemporaneous reclamation including, but not limited to back regrading, topsoil replacements at revegetation. Achieve approximate original contours, eliminate all high spoil piles, and depressions. .102-Achieve a post action slope not exceeding angle of repose or such slope as is necessary to achieve a long-term static safety factor of 1.0 to prevent slides.	Site Wide

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
2. Threshold Limit Values (TLVs)	Established by American Conference of Governmental Industrial Hygienists (ACGIH)	Releases of airborne contaminants during remedial activities.	TLVs are based on the time weighted average (TWA) exposure to an airborne contaminant over an 8-hour work day or a 40-hour work week. Identify levels of airborne contaminants with which health risks may be associated. Since there are no ARARs for several of the contaminants of concern- arsenic, antimony, copper, cadmium, mercury, zinc-the TLVs should be considered ARARs for airborne emission of such chemical TLVs for the contaminants of concern as follows: Antimony 500 $\mu g/m^3$ Arsenic 200 $\mu g/m^3$ Cadmium 50 $\mu g/m^3$ Copper fume= 200 $\mu g/m^3$ dust= 1,000 $\mu g/m^3$	Site Wide

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
2. Threshold Limit Values (TLVs) (Continued)			Lead 150 $\mu g/m^3$ Mercury alkyl=10 $\mu g/m^3$ Except Alkyl: vapor=50 $\mu g/m^3$ inorganic=100 $\mu g/m^3$ Zinc ZnCl=1,000 $\mu g/m^3$ Zinc Oxide: fume=5,000 $\mu g/m^3$ dust=10,000 $\mu g/m^3$	Site Wide
3. Treatment, Storage, or Disposal of Hazardous Waste	40 CFR 264.13, .14	The treatment, storage, or disposal of RCRA regulated wastes.	Prevent unknowing entry and minimize the possibility of unauthorized entry of persons or livestock to the active portion of the facility. Includes: - artificial or natural barrier completely surrounding the active area - a means to control entry - a sign stating '*Danger, Unauthorized Personnel Keep Out*'	CIA, Page Pond, MOA, and Smelterville Flats

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
4. Closure Requirements	RCRA/HWMA 40 CFR §264, Subpart G	Closure of hazardous waste repositories must meet protective standards.	Regulations to minimize contaminant migration, provide leachate collection and prevent contaminant exposure will be met.	Smelter Complex
5. Landfill Design and Construction	RCRA/HWMA 40 CFR §264, Subpart N	Hazardous waste landfills must meet minimum design standards.	Protectiveness will be achieved through capping and institutional controls.	Smelter Complex
6. Ground Water Monitoring	RCRA/HWMA 40 CFR §264, Subpart F	Establishes standards for detection and compliance monitoring.	Site wide monitoring will accommodate specific ground water monitoring requirements.	Smelter Complex
	40 CFR §264, Subpart X			Wetlands System
7. Land Disposal Restrictions (LDRs)	RCRA/HWMA 40 CFR §268	LDRs place specific restrictions (conc or trtmt) on RCRA hazardous wastes prior to their placement in a land disposal unit.	Relevant and appropriate LDR requirements will be met if any material accumulations are treated ex situ.	MOA and Smelter Complex

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
8. Closure requirements	RCRA/HWMA 40 CFR §264, Subpart G	Closure of hazardous waste repositories must meet protective standards.	Protectiveness will be achieved through capping and institutional controls.	CIA, Page Pond
9. Ground Water Monitoring	RCRA/HWMA 40 CFR §264, Subpart F	Establishes standards for detection and compliance monitoring.	Site wide monitoring will accommodate specific ground water monitoring requirements.	Smelterville Flats, Page Pond, CIA, MOA, and Hillsides
10. NPDES Storm Water Discharge	40 CFR Part 122.26	Establishes permitting process and discharge regulations for storm water.	Relevant and appropriate for alternatives where mine material comes into contact with storm water or snowmelt.	Site Wide
C. To Be Considered Materials				

Table 10-3
Federal Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
1. Estimated Limit Values (ELVs)	Established by American Conference of Governmental Industrial Hygienists (ACGIH).	Releases of airborne contaminants during remedial activities.	ELVs are based on Threshold Limit Values (TLVs) and converted to reflect exposure to contaminants on a 24-hour/day basis. The calculation of an ELV does not take into consideration the additive and synergistic effects of contaminants and additional exposures from media other than air. ELVs are not expected to be completely protective of the potential effects of exposures to contaminants; however, they do provide some indication of airborne contaminant levels at which adverse health effects could occur. Since there are no ARARs for several of the contaminants of concern-arsenic, antimony, copper, cadmium, mercury, and zinc-the ELVs should be considered TBC for remedial activities which will cause airborne emission of such chemicals. The ELVs for the contaminants of	

Table 10-3 Federal Action-Specific ARARs				
Action-Specific	Citation	Prerequisite	Requirement	Location
1. Estimated Limit Values (ELVs) (Continued)			Mercury alkyl= 0.2 $\mu g/m^3$ Except alkyl: vapor= 1.0 $\mu g/m^3$ inorganic= 2.0 $\mu g/m^3$ Zinc ZnCl= 20.0 $\mu g/m^3$ Zinc Oxide: fume = 120 $\mu g/m^3$ dust = 200 $\mu g/m^3$	

Table 10-4
State of Idaho Chemical-Specific ARARs

Chemical-Specific	Citation	Prerequisite	Requirement	Location
I. Air				
A. Applicable Requirement				
1. Toxic Substances	IDAPA §16.01.1011, 01	Emission of air contaminants that are toxic to human health, animal life, or vegetation.	Emissions of air contaminants which occur during remedial activities will not be in such quantities or concentrations with other contaminants, injure or unreasonably affect human health, animal life or vegetation.	Site Wide
B. Relevant and Appropriate	None			
C. To Be Considered	None			
II. Soil	None			

Table 10-5
State of Idaho Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
I. Air				
II. Soil				
A. Applicable Requirement				
1. Areas Adjacent to or in the Vicinity of State Waters	IDAPA §16.01.2800	Storage or disposal of hazardous or deleterious materials in the vicinity of, or adjacent to, state waters.	The remedial action will be designed with adequate measures and controls to ensure stored or disposed contaminated soils will not enter state waters as a result of high water, precipitation, runoff, wind, facility failure, accidents or third-party activities.	
2. Preservation of Historic Sites	I.C. § 67-4601 to 4619	Property within areas of the Site is included in the National Register of Historic places	The remedial action will be designed to minimize the effect on historic landmarks.	Site wide

Table 10-5
State of Idaho Location-Specific ARARs

Location-Specific	Citation	Prerequisite	Requirement	Location
B. Relevant and Appropriate				
1. Siting of Hazardous Waste Disposal Facility	I.C. §§39-5801 et seq.	Siting of a hazardous waste disposal facility.	The remedial action will be designed to satisfy some of the technical criteria in the Idaho Hazardous Waste Siting Management Plan as adopted by the Idaho Legislature. Consideration will be given in remedy design to general considerations referenced by the Hazardous Waste Facility Siting Act. However, a siting license for an onsite hazardous waste disposal facility is not required.	
2. Endangered Species	I.C. § 36-201	Determination of presence of endangered of threatened species.	Remediation will be designed to conserve endangered or threatened species, and their habitat.	Site wide

Table 10-6
State of Idaho Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
I. Air				
A. Applicable Requirement				
1. Fugitive Dust	IDAPA §16.01.1251-16.01.1252	Emission of airborne particulate matter.	The remedial action will be designed to take all reasonable precautions to prevent particulate matter from becoming airborne including but not limited to, as appropriate, the use of water or chemicals as dust suppressants, the covering of trucks and the prompt removal and handling of excavated materials.	
II. Soil				
A. Applicable Requirement				
1. Management of Solid Waste	IDAPA §§16.01.5000 et seq.	Management of solid waste including storage, collection, transfer, transport, processing, separation, treatment and disposal.	The remedial action will be designed to manage solid waste to prevent health hazards, public nuisances and pollution to the environment in accordance with the applicable solid waste management requirements. No permit is required for onsite actions.	

Table 10-6
State of Idaho Action-Specific ARARs

Action-Specific	Citation	Prerequisite	Requirement	Location
2. Activities Generating Non-point Discharges to Surface Waters	IDAPA §§16.01.2050, 06 and 16.01.2300,04	Construction and other activities which may lead to non-point source discharges to surface waters.	The remedial action will be designed to utilize best management practices or knowledgeable and reasonable efforts in construction activities to minimize adverse water quality impacts and provide full protection or maintenance of beneficial uses of surface waters.	
B. Relevant and Appropriate				

Table 10-6 State of Idaho Action-Specific ARARs				
Action-Specific	Citation	Prerequisite	Requirement	Location
1. Management of Hazardous Waste	I.C. §§39-4401 et seq., IDAPA §§16.01.5000 et seq.	Generation, transportation, storage or disposal of hazardous waste.	The remedial action will be designed to manage any hazardous waste that may be generated by the remedial action in accordance with the relevant and appropriate generation, transportation, storage and disposal requirements for such waste. Onsite actions are exempt from some requirements, and permits are not required for onsite activities.	
2. Land Disposal Restrictions	IDAPA § 16.01.5011	LDRs place specific restrictions (conc or trtmt) on RCRA hazardous wastes prior to their placement in a land disposal unit.	Relevant and appropriate LDR requirements will be met if any material accumulations are treated ex situ.	
C. To Be Considered	None			

10.3 COST-EFFECTIVENESS

U.S. EPA believes the selected remedy is cost-effective in mitigating risks posed by contaminated soils, ground water, surface water, and material accumulations at the Bunker Hill Site. Section 300.430(f)(ii)(D) of the NCP requires an evaluation of cost-effectiveness by comparing all the alternatives that meet the threshold criteria (protection of human health and the environment) against three additional balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness). The selected remedy meets these criteria and provides overall effectiveness in proportion to its cost.

The selected remedy includes source controls and treatment. Institutional controls will ensure long-term maintenance of the physical and institutional barriers that protect against contaminant exposures. This alternative is attractive because of the relatively low cost (approximately $52.0 million net present worth) and expected effectiveness.

The principal difference between the selected remedy and the other two alternatives is the amount of treatment. One alternative relies primarily on source containment. Although less expensive that the selected remedy, source containment would provide a less effective means of protecting human health and the environment since no water treatment, either surface or ground, is included in this alternative. Although Alternative 4 would remove more contaminated materials for consolidation onsite, the associated cost of $120.3 million was substantially higher than that for the selected remedy, the added effectiveness would be marginal with respect to the additional cost. The selected alternative was therefore determined to be more cost-effective.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

U.S. EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at the Site. Of the three alternatives protective of human health and the environment and in compliance with ARARs, the selected remedy provides the best balance in terms of long term effectiveness; implementability; and cost. Also, the selected remedy considers the statutory preference for treatment as a principal element and considers community acceptance.

Long-term effectiveness was the primary reason for selecting Alternative 3 over Alternative 2. The treatment included in the selected remedy provides more permanent controls. The cost of removals in Alternative 4 was too high compared to Alternative 3, considering the associated incremental improvement in performance.

The selected remedy utilizes alternative treatment and resource recovery technologies to the maximum extent practicable. All materials, including Principal Threat materials and demolition debris, will be evaluated for reprocessing or recycling before disposal onsite. Innovative treatment was selected for both ground and surface water in a constructed wetlands treatment systems to remove metals. Principal Threat materials that cannot be reprocessed or recycled will be treated by cement based stabilization. The treatment process will reduce the mobility of the contaminants by stabilizing them in a solid matrix.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy satisfies the statutory preference for treatment as a principal element. The recycling and reprocessing of all materials practicable, cement-based stabilization treatment of remaining Principal Threat materials, and the treatment of both surface and ground water in the wetlands treatment system are all principal elements of the selected remedy. The treatment, along with the engineering controls, is consistent with the Superfund program expectations stated in the NCP (40 CFR §430(a)(1)(iii)(B)).

11 REFERENCES AND ACRONYMS

All references may be found in the Administrative Record for the Site, or otherwise publicly available.

1. Bunker Hill Superfund Site Feasibility Study Report (FS). May 1, 1992. Prepared by McCulley, Frick, and Gilman, Inc. Volumes I, II, III, and associated Technical Memoranda.

2. Bunker Hill Superfund Site Remedial Investigation Report (RI). May 1, 1992. Prepared by McCulley, Frick, and Gilman, Inc. Volumes I, II, and III.

3. CH2M Hill. 1991. Residential Soil Feasibility Study for The Bunker Hill CERCLA Site Populated Areas RI/FS (RI/FS). Document Number BHPA-RSFS-F-RO-041991.

4. Ecological Risk Assessment for The Bunker Hill Superfund Site (ERA). November, 1991. Prepared by Science Applications International Corporation, Technology Service Company (SAIC, 1991).

5. Final Human Health Risk Assessment for The Non-populated Areas of The Bunker Hill NPL Site (HHRA). June 1992. Prepared by Science Applications International Corporation, Technology Services Company (SAIC, 1992).

6. Gott, G.B. and J.B. Cathrall. 1980. Geochemical Exploration Studies in The Coeur d'Alene District, Idaho and Montana. Geological Survey Professional Paper 1116, U.S. Department of Interior. U.S. Government Printing Office, Washington D.C. 1980.

7. Record of Decision (ROD). Bunker Hill Mining and Metallurgical Complex Residential Soils Operable Unit. Shoshone County, Idaho. August 1991. Prepared by Idaho Department of Health and Welfare (IDHW).

8. Risk Assessment Data Evaluation Report (RADER) for The Populated Areas of The Bunker Hill Superfund Site. October 18, 1990. Prepared by Terragraphics Environmental Engineering.

9. Technical Memorandum Evaluating Regulatory Requirements for The Bunker Hill Site. June 1992. Document Number: TZ4- C10010-EP-10748.

10. The Revised Final National Contingency Plan (NCP). April 1990.

11. U.S. EPA. 1992.

12. U.S. EPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. October 1988. Office of Emergency and Remedial Response.

13. Chapter 11 Bankruptcy Plan of Reorganization, In Re Bunker Limited Partnership, No. 91-02087K11 (July 13, 1992, D. Wash.).

14. Chapter 11 Bankruptcy Plan of Liquidation, In Re Bunker Hill Mining Company (U.S.), Inc., No. 91-00161 (August 22, 1991, D. Idaho).

15. Evaluation of Institutional Controls for the Populated Areas of the Bunker Hill Superfund Site (Draft), January 25, 1991, For Panhandle Health District by Gale Allen and Jerry Mason.

16. Human Health Risk Assessment Protocol For the Populated Areas of the Bunker Hill Superfund Site, U.S. EPA Contract No. 68-01-7351, Jacobs Engineering Group, Inc., ICAIR, Life Systems, Inc., and TerraGraphics, Inc. (September 1989).

17. Interim Site Characterization Report for the Bunker Hill Site, U.S. EPA Contract No. 68-01-6939, Woodward-Clyde Consultants and TerraGraphics (August 4, 1986).

18. In the Matter of a Petition by the United States of America to Unseal The File in Yoss v. Bunker Hill Company et al., Civ. No. 77-2030 (D. Idaho, Case No. MS-3505, July 2, 1990).

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Materials
ALC	Aquatic Life Criteria
AOC	Area Of Contamination
ARARs	Applicability or Relevant and Appropriate Requirements
As	Arsenic
ATSDR	Agency for Toxic Substances and Disease Registry
BDAT	Best Demonstrated Available Technology
BH	Bunker Hill
BHMC	The Bunker Hill Mining Company (U.S.), Inc.
BLP	Bunker Limited Partnership
Cd	Cadmium
CDC	Center for Disease Control
CDFD	Copper Dross Flue Dust
CDFDP	Copper Dross Flue Dust Pile
CDR	Coeur d'Alene River
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Central Impoundment Area
CMCs	Combined Metal Concentrations
CMLs	Combined Metal Loadings
CPFs	Cancer Potency Factors
CTP	Central Treatment Plant
CWA	Clean Water Act
cy	cubic yard
dl	deciliter
DWS	Drinking Water Standards
ELVs	Estimated Limit Values
ERA	Ecological Risk Assessment
FDM	Fugitive Dust Model
FEMA	Federal Emergency Management Act
FR	Federal Register
FS	Feasibility Study
FWQC	Federal Water Quality Criteria

gm	gram
HEPA	High Efficiency Particulate Analyzer
HHRA	Human Health Risk Assessment
HWMA	Hazardous Waste Management Act
IC	Institutional Controls
ICN	Idaho Citizens Network
ICP	Institutional Control Program
IDAPA	Idaho Administrative Procedures Act
IDHW	Idaho Health and Welfare
IDT	Idaho Department of Transportation
LDRs	Land Disposal Restrictions
Lin. ft.	linear feet
MCI	Minerals Corporation of Idaho
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MOA	Mine Operations Area
mg/kg	milligram per kilogram
mg/mg	microgram per milligram
m^3	cubic meter
MTR	Minimum Technology Requirements
NAAQS	National Ambient Air Quality Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NQ	Not Quantified
OSWER	Office of Solid Waste Emergency Response
Pb	Lead
PCBs	Polychlorinated Biphenyls
PHD	Panhandle Health District
ppm	parts per million
PRP	Potentially Responsible People
PWTP	Page Water Treatment Plant
RADER	Risk Assessment Data Evaluation Report
RAO	Remedial Action Objective
RCRA	Resource Conservation Recovery Act
RI	Remedial Investigation

RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROW	Rights-of-Way
RSFS	Residential Soils Feasibility Study
SAIC	Science Application International Applications
SARA	Superfund Amendment Reauthorization Act
SCR	Site Characterization Report
SDWA	Safe Drinking Water Act
SFCDR	South Fork of Coeur d'Alene River
SPMI	Sunshine Precious Metals, Inc.
sq.ft.	square feet
TCLP	Toxicity Characteristic Leaching Procedure
TLV	Threshold Limit Value
TMDL	Total Maximum Daily Load
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
UAO	Unilateral Administrative Order
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Services
U.S.C.	United States Code
Zn	Zinc
ZnCl	Zinc Chloride

APPENDIX A

BUNKER HILL RESPONSIVENESS SUMMARY

Overview

A. Description of selected remedy.

The selected remedy addresses the site wide Remedial Action Objectives by utilizing a combination of: source containment (in-place caps); selective source removal; drainage and erosion controls; innovative treatment of ground water and surface water; treatment of selected contaminant source materials; and, institutional controls. The selected remedy was developed to utilize a combination of innovative and conventional engineering controls and treatment options with respect to ground water and surface water, in particular. The selected remedy will also use cement-based stabilization to treat all Principal Threat materials before they are contained, when they are not recycled or reprocessed. This remedy would reduce and/or eliminate the exposure of contaminants in soil/source materials, surface water, ground water, and airborne dusts.

B. Changes to remedy presented in Proposed Plan.

In the 1991 Residential Soils Record of Decision, residential soils were originally intended to be consolidated on the Page Pond or another suitable area onsite. For clarification, it is now also appropriate to utilize residential soils as a sub-base material for the closure of the Lead Smelter and Zinc Plant, or as a component of the final cover of these closures as long as surface concentrations of the completed cover are below 1,000 ppm lead and access to these closures is controlled.

Language has been added to Section 10 of the ROD to clarify when contingency waiver of ground water ARARs in the main valley would become effective based upon technical impracticability. It has been further clarified that, while remedial actions outlined in this ROD seek to limit the impacts of site contaminant sources to the South Fork Coeur d'Alene River (SFCDR), achievement of Federal Water Quality Criteria (FWQC) in the river is beyond the scope of this CERCLA action and attainment of FWQC in the river is not an ARAR for this ROD. Rather, achievement of FWQC will be addressed through the Coeur d'Alene River Basin Restoration Project.

Preliminary results of treatability testing of Principal Threat material accumulations indicate that a rain water leach test is more appropriate than the acid leach test which is typically utilized for design of stabilization mixtures meeting Land Disposal Restriction requirements. This is because a rain water leach test more accurately replicates the conditions at the Site where these materials will be located. Therefore, a rain water leach test will be used in lieu of an acid leach test to design the cement-based stabilization mixture for treatment of Principal Threat wastes.

C. New alternatives suggested by the public which U.S. EPA had not previously considered.

The Idaho Citizens Network has advocated the creation of a medical trust fund as a part of the selected remedy for this Site. This trust fund has not been included as a part of the selected remedy because U.S. EPA does not have the authority under CERCLA to require the creation of such a trust fund.

The Coeur d'Alene Tribe of Idaho and the federal natural resource trustees have recommended that a fifth alternative, one requiring a total restoration of the entire basin, should be considered. Elements of a "total restoration alternative" (such as the total removal of all jig tailings within the Site) were evaluated in the Feasibility Study process and rejected as technically impracticable. Further, other remedial activities both upstream and downstream of the Site are not within the scope of this ROD and will be addressed under the Coeur d'Alene Basin Restoration Project.

D. Level of community support for Preferred Alternative.

Based on public comment, it appears that the public overwhelmingly favored the proposed remedy. One of the major concerns raised was that the cleanup should begin as soon as possible. A local citizens group expressed support for the proposed alternative and would like to see health issues addressed. This citizens group has requested that a "health trust fund" be established to address their concerns.

A complete summary of all comments received from the public and PRPs, as well as agencies responses, are included in this Responsiveness Summary.

Background on Community Involvement

A. Brief history of community interest in the Site and identification of key public issues.

The Economy

The closing of the Bunker Hill Smelter Complex and the Bunker Hill Mine and Mill in 1981 resulted in approximately 2,000 jobs being lost to the area. With the nomination of this Site for inclusion on the National Priorities List in December 1982, there was considerable local concern that such a listing would further jeopardize any economic revitalization efforts in the area. Since the final listing of this Site in October 1983, most of the community concern has continued to be about the adverse impact this Superfund listing has had on the local economy and property values. In particular there has been great community concern over the potential liability of prospective purchasers and commercial property lenders regarding the purchase of properties within the Site.

For the past several years U.S. EPA, IDHW, and the Panhandle Health District (PHD) have worked with the U.S. Department of Housing and Urban Development, local government, and various lending institutions in an attempt to ease concerns about lender liability. Efforts have included numerous meetings with various governmental agencies and private groups including most recently a workshop in March 1992, to provide a forum on economic development within the Site for executive officials of commercial lending institutions in Idaho and other Northwest states.

In addition, to ease concerns about development within the Site, U.S. EPA also entered into a prospective purchaser settlement agreement to facilitate construction of the Silver Mountain Gondola, which has since been completed. The project has helped enhance the local tourism industry.

Blowing Dust

Since the beginning of the Superfund project there have also been continued concerns about blowing dust in the area. The large tailings impoundment in the middle of the Site (the Central Impoundment Area) and also the barren areas in the floodplains have been a major source of wind-blown dust. Periodic dust storms, usually in the dry summer months, have spread contaminated fugitive dust throughout the Site.

Through several administrative orders and also cooperative efforts, several major dust control efforts have been conducted in the area over the past several years. At this time, the tailings pond and the gypsum pond of the Central Impoundment Area are being cover with clean rock to control airborne dust. In addition, a variety of temporary and permanent dust control measures have been implemented at locations throughout the Site including a truck stop, a RV park, a lumber yard and, numerous open areas and rights-of-way.

Health Concerns

In the last few years, particularly since the completion of the human health risk assessment work and its presentation to the public, there seems to be a growing interest in the potential health issues facing the communities within the Site. Concerns have been expressed about the potential health effects for small children, the potential health effects related to occupational exposures when the Smelter Complex and Mill facilities were in operation, and concerns about house dust in particular.

Workshops and public meetings have been held over the past several years to discuss risks as well as how these risks can be minimized. The Health Intervention Program, implemented by the Panhandle Health District, was also established to address health concerns including annual blood lead monitoring of children.

In an attempt to reduce exposures to the sensitive sub-population of small children and pregnant women, residential yard removals have been conducted during the past four summers. By the end of the 1992 construction season, the replacement of approximately 400 yards will have been completed.

Project Duration

There has been continued community concern over the length of time it has taken to conduct the RI/FS and begin Site remediation. U.S. EPA recognized this concern and responded with nine separate removal actions at public parks and playgrounds, residential yards, the Smelter Complex, and the hillsides. The size of this Site and the number of PRPs, government agencies, and other interested parties involved have all contributed to the complexity of the RI/FS project.

B. Noting of major modifications in the preceding investigation, operable units, or removal actions which were the result of public comment and concern.

In response to public concerns, dust control efforts throughout the Site, the revegetation and stabilization work on the hillsides, and the fire protection measures at the Smelter Complex have all been implemented prior to the selection of the final remedy.

C. Listing of community relations activities conducted to date.

The specific requirements for public participation at the Site under CERCLA, as amended by SARA, include releasing the RI/FS and Proposed Plan for the actions selected in this ROD to the public. This was done on June 15, 1992. Both documents were placed in the Administrative Record and information repositories. Notices of the availability of these documents, a public meeting on the Proposed Plan and a public comment period was published in the Spokesman-Review and Shoshone News Press on June 13, 1992; reminders of the public meeting were placed in the Shoshone News Press on June 20, 21, 23, 24, and 25, 1992. The initial public comment period was from June 15 to July 15, 1992; it was extended to August 14, 1992, after a request to extend the comment period was received. A public meeting was held on June 25, 1992. Comments from the public were taken and are summarized in the Responsiveness Summary portion of this document along with all written comments that were submitted during the comment period.

There has been a long history of community relations activities in the Silver Valley. Since discovery of elevated blood leads levels in children in 1974, the IDHW, Panhandle Health District (PHD), and the CDC have continually worked with area residents to reduce lead exposures. In 1985, the Shoshone County Commissioners selected a nine member Task Force to serve as a citizen's advisory group to the Bunker Hill Superfund Project Team. The PHD was contracted by IDHW to perform community relations tasks for the Site. A full time IDHW staff person has also been stationed onsite from mid-1987 to present. Part of the Task Force's duties is to assist in community relation activities when needed.

Community relations activities have focussed on maintaining effective communication between the citizens living on the Site and the agencies. Actions taken have been consistent with the requirements of the federal law and have provided an ongoing forum for citizen involvement in reaching the remedial action decision through the Bunker Hill Superfund Task Force.

Information repositories have been created for the public to have access to minutes of public meetings, all major project documents, fact sheets, orders, and other pertinent information related to the Site. These repositories are located at the Kellogg Public Library, Kellogg City Hall, Pinehurst/Kingston Public Library, and Smelterville City Hall. In addition, Administrative Records of all U.S. EPA response actions to date are maintained at the Kellogg Public Library.

The community relations activities that have occurred at the Site since May 1985, are summarized in Section 3 of the ROD.

Summary of Comments Received and Agency Response:

Comments raised during the Bunker Hill Proposed Plan public comment period are summarized below. U.S. EPA received 83 letters concerning the Proposed Plan during the public comment period.

A public meeting was held on June 25, 1992, at the Kellogg Middle School. About 200 people attended the meeting and approximately 40 people gave public comments. The meeting consisted of presentations by U.S. EPA, Idaho Department of Health and Welfare, and the Panhandle Health District. A representative for the Agency for Toxic Substances and Disease Registry was also present to help answer questions about health concerns.

During the meeting, citizens asked questions which dealt with such topics as health concerns and the timing of the cleanup. A transcript of this meeting, entitled Bunker Hill Proposed Plan Public Meeting, June 25, 1992, is available in the Administrative Record at U.S. EPA Office in Seattle, as well as the Superfund information repository in the Kellogg Library.

This Responsiveness Summary addresses the comments received by U.S. EPA concerning the Proposed Plan for cleanup of the Site. Comments submitted during the comment period and at the public meeting are summarized below.

Many of the comments addressed similar concerns and have been grouped accordingly. The summary of comments has been organized into two main sections for clarity:

Section I provides a summary of the communities' concerns. This section includes general comments from the public and, local and state officials. It also includes the results of a survey conducted by the Idaho Citizens Network during the public comment period.

Section II provides a comprehensive response to all specific technical and legal comments. Comments received from the Department of Interior, the Coeur d'Alene Tribe of Idaho, also from the Potentially Responsible Parties, and U.S. EPA's responses to those comments are presented in this section. Because of the extensive nature of these comments, the original comment letters are reproduced with U.S. EPA's responses inserted into the appropriate places. The following letters are included:

Appendix B Department of the Interior comments

Appendix C Coeur d'Alene Tribe of Idaho comments on the Proposed Plan

Appendix D Coeur d'Alene Tribe of Idaho comments on the RI/FS

Appendix E Comments from the Potentially Responsible Parties

SECTION I
General Comments from the Public, and Local and State Officials

Preferred Alternative:

Approximately 85 citizens and the following local organizations expressed support for the preferred alternative: Kellogg Rotary Club, Silver Valley Kiwanis Club, Silver Valley Economic Development Corporation and the Silver Mountain Board of Directors. In addition, the Fire Chief of Kellogg, Idaho Fish and Game, the city of Pinehurst, the city of Kellogg and the city of Wardner support the preferred alternative.

Comment: Ten commentors and the Silver Mountain Board of Directors commented that the project should be completed as soon as possible so that economic growth can begin in the area.

U.S. EPA RESPONSE: Comment noted.

Comment: The Idaho Department of Health and Welfare North Regional Office and the Idaho Fish & Game expressed concern about the lack of fish habitat in the South Fork. They want the wetlands section of the Proposed Plan to include restoration of the river (creation of pools, riparian vegetation and rocks). Both agencies conclude that lack of pool habitat is likely to be as much of a limiting factor to the trout population as the presence of heavy metal concentrations.

U.S. EPA RESPONSE: U.S. EPA and U.S. Department of the Interior have signed an Interagency Agreement for the U.S. Fish and Wildlife Service to act as a consultant when working on the wetlands portion of the cleanup plan. In addition, U.S. EPA will work with the state agencies to see that their concerns have been addressed. The selected remedy includes a 500 foot floodway that will have riparian habitat restoration.

Comment: Two citizens expressed concern that the proposed wetlands are not big enough to handle the amount of water that will need treatment. One of the citizens proposed a standby water treatment system be put in at the bottom of Government Gulch as a backup.

U.S. EPA RESPONSE: The wetlands treatment systems are designed to handle low flows from identified contaminant sources. High flows are expected to be addressed in the long term by source control remedial actions, and by storm water Best Management Practices to be developed during remedial design.

Comment: The Mayor of Wardner and several citizens thanked U.S. EPA for the activities that have been conducted so far in Wardner. The Mayor expressed interest in the cleanup taking place as quickly as possible.

U.S. EPA RESPONSE: Comment Noted.

Comment: The Mayor and the Kellogg Council expressed concern about funding for the Institutional Controls Program. Kellogg has no funds available. They are also concerned that the construction activities during the cleanup will have an effect on the city streets and would like to see adequate funds available for repair or replacement of streets damaged by the construction.

U.S. EPA RESPONSE: As stated in the ROD, any repairs required to community infrastructure, such as roads and utilities, due to the implementation of the remedial actions required in the ROD, will be conducted as appropriate.

Comment: A citizen wrote that he would like to see a program instituted where residents could get free trees and native shrubs to plant on their property.

U.S. EPA RESPONSE: U.S. EPA is unable to provide residents with trees and native shrubs. Work being conducted on the hillsides is to help control erosion and reduce dust blowing.

Comment: Two citizens expressed concern that the pensions and other retirement benefits would be jeopardized if there were any further costs to the PRPs.

U.S. EPA RESPONSE: U.S. EPA shares citizens concerns about the pensions and other retirement benefits. U.S. EPA has determined that the selected remedy is the most cost effective response at this Site.

Comment: The Idaho State Historical Society wrote that the remedial action must be reviewed under Section 106 of the National Historic Preservation Act and recommended U.S. EPA contract with a historian to photograph the Site and document the history of the complex through archival research and oral histories. All areas subject to disturbance by actions such as erosion control or channelization should be inspected for historic properties by professional archaeologists.

U.S. EPA RESPONSE: The National Historic Preservation Act is an ARAR (see Section 10 of the ROD), and therefore the requirements of that law must be complied with.

Comment: The Chairman of the Task Force spoke on behalf of the Task Force in support of Alternative #3. He said that the Institutional Controls portion of the Alternative is crucial to the plan and wanted to make sure that money is available. They would like to see the CIA have a cap that can be used for walking trails or a park in the future.

U.S. EPA RESPONSE: An Institutional Controls Program is required by the ROD. It is U.S. EPA's intention to require the PRPs to provide the financial support for the program as a part of their good faith proposal in response to the upcoming special notice for consent decree negotiations.

Comment: A citizen expressed concern that the Institutional Controls Program should not be a burden to the citizens of the community and only those controls necessary should be implemented.

U.S. EPA RESPONSE: U.S. EPA agrees that only the controls necessary will be implemented.

Comment: One citizen said that the cleanup should be completed in no more than three years after the start of the cleanup.

U.S. EPA RESPONSE: U.S. EPA intends to move as quickly as possible. Due to the volume of material and the amount of work, it will take more than three years.

<u>Other Alternatives:</u>

Comment: One citizen supports Alternative #4 because the preferred alternative does not adequately address domestic water. He felt that a water purification system is the only way the Kellogg community can be sure that the water they drink is safe.

U.S. EPA RESPONSE: The current water supply is not from the site ground water, but rather is from surface sources not impacted by site wide contamination. An additional surface water supply outside of the Site is also being developed at this time.

<u>Local Citizens Group:</u>

Comment: Several citizens expressed concern that a local citizens group may delay the cleanup. They feel that this group does not represent the citizens of the area.

U.S. EPA RESPONSE: Comment Noted.

Comment: Several citizens and the city of Pinehurst expressed concern about a health trust fund initiated by a local citizens group. They are concerned that people may be moving into the area to take advantage of any money collected for medical treatments.

U.S. EPA RESPONSE: The selected remedy does not include a medical trust fund because U.S. EPA does not have the authority under CERCLA to require such a fund.

Comment: One citizen expressed concern that the trust fund would add additional costs to the cleanup effort which could be devastating to employees dependent on pension payments and health insurance coverage currently provided by the PRPs.

U.S. EPA RESPONSE: Again, the selected remedy does not include a medical trust fund.

Health Issues:

Comment: One citizen requested that free blood tests continue in the future so that children's health history can be followed.

U.S. EPA RESPONSE: The Agency for Toxic Substances and Disease Registry has agreed to fund the blood-lead studies next year. Continued blood lead screening is a component of the selected remedy.

Comment: A citizen wanted to know why medical care was not being addressed in the proposed plan.

U.S. EPA RESPONSE: U.S. EPA will continue to work with appropriate health agencies to address public health concerns.

Comment: A representative of the Idaho Citizens Network said that the group thinks Alternative #3 is the best plan for the Site. They nevertheless do not think that it addresses the health of children who have been tested and have unacceptable lead levels. They also demand a trust fund be established for ongoing health intervention which would include a permanent school nurse to help monitor all school children and provide testing to the 12th grade. They want carpet removal, vacuuming and shampooing to be conducted as soon as possible to remove heavy metals present in the interior of homes.

U.S. EPA RESPONSE: U.S. EPA's mandate in CERCLA is cleanup of the Site and the control of the environmental conditions. U.S. EPA does not have the authority to require health care for past exposures at the Site. With regard to interior house cleaning, U.S. EPA recommends that residents continue individual house cleaning efforts while the remedial

activities continues at the Site. Special high efficiency vacuum cleaners can be borrowed from the Superfund Project Office in Kellogg to assist in this effort. As stated in the ROD, after the completion of site wide remedial actions, all homes with house dust lead concentrations equal to or exceeding 1,000 ppm will have a one-time cleaning of residential interiors. If subsequent interior house dust sampling indicates house dust lead concentrations exceed a site wide average of 500 ppm the need for additional cleaning will be evaluated.

Local Hires:

Comment: Several citizens expressed support to have priority for jobs during the cleanup to be given to local residents.

U.S. EPA RESPONSE: The agencies will continue to encourage the hiring of local citizens to assist with the cleanup whenever possible. However, hiring for the cleanup will be the decision of the private companies.

Site Boundary Issues:

Comment: A commentor from the State of Washington felt the next phase of the Superfund study should address the contamination levels at Cataldo Flats and the lower river.

U.S. EPA RESPONSE: Other contaminated areas within the Coeur d'Alene Basin may be evaluated and addressed separately under CERCLA and/or other statutory mechanisms. A multi-media approach to the Coeur d'Alene Basin is currently being pursued within the framework of the Coeur d'Alene Basin Restoration Project.

Yards Done:

Comment: A citizen felt that the work that was done on the yards was wasteful and unnecessary.

U.S. EPA RESPONSE: U.S. EPA disagrees and feels that past information supported the removal and replacement of yards soils.

Comment: A citizen expressed concern that wind blown dust is recontaminating the yards that have been remediated. The result being a total waste of effort, time and money. He felt that too much money has been spent on studies and evaluations.

U.S. EPA RESPONSE: U.S. EPA has retested the parks and playgrounds which were remediated in 1986 and has found little recontamination. The levels have remained significantly lower than what they were before these areas were remediated.

Safety:

Comment: The Fire Chief for the city of Kellogg and Shoshone County Fire Protection District No. 2 is concerned about the possibility of fire at the smelter complex resulting in the release of airborne contaminants and also about the safety of the fire fighters working during a fire or rescue emergency in the smelter complex.

U.S. EPA RESPONSE: U.S. EPA understands the concern. The 1991 Administrative Order on Consent with the PRPs provided for Hazardous Materials training and some additional fire fighting equipment. This Order, which is still in effect, also provides for the maintenance of the water supply at the Smelter Complex in case of an emergency. U.S. EPA will ensure that such provisions are continued until the buildings are removed or decontaminated.

General Comments:

Comment: One citizen expressed concern that too much cleanup may bankrupt the PRPs. He felt that what the mining companies did was legal at the time and everyone benefitted from the mining activities.

U.S. EPA RESPONSE: Comment Noted.

Comment: A citizen asked if there had been any samples taken of the water in the Pinehurst Narrows area of Pine Creek.

U.S. EPA RESPONSE: During the remedial investigation three surface water sampling locations were established in the Pine Creek area. Sampling location "PC-1" was located in Pine Creek above Pinehurst, "PC-2" was located at the mouth of Pine Creek, and "LP-1" was located at Little Pine Creek above Pinehurst. In general, Pine Creek did not contribute appreciable metal loads to the South Fork of the Coeur d'Alene River during the remedial investigation study. All metals concentrations were below drinking water standards. However, the acute aquatic life criteria standard for zinc was exceeded at "PC-1" and "PC-2".

Comment: A citizen said he would like to see U.S. EPA do as much publicity about the clean up as they did telling everyone how dirty the place was.

U.S. EPA RESPONSE: U.S. EPA agrees that there should be as much publicity about the Site being cleaned up and has kept the media up to date on all activities that have occurred at the Site. The media has been contacted several times regarding "good news" and no stories were printed. U.S. EPA will continue to provide the media with information about the cleanup efforts.

Idaho Citizens Network Survey

The Idaho Citizens Network (ICN) conducted a survey during the public comment period. A total of 301 people responded to ICN's survey. These responses were forwarded to U.S. EPA. Concerned members of the community were encouraged to contact U.S. EPA representatives directly through U.S. EPA's toll-free telephone number. ICN's survey contained the following points:

Item 1: Most people checked the box to have $5 million of the cleanup money to be set aside for a trust fund for treatment and intervention of people who have been effected by the Site.

U.S. EPA RESPONSE: This concern has been addressed many times in the past. As stated earlier, U.S. EPA is unable to require health care for past activities. U.S. EPA has determined that the selected remedy is protective of human health.

Item 2: Approximately half of the people surveyed checked the box that the Preferred Alternative should be the final cleanup plan for the Site.

U.S. EPA RESPONSE: Comment Noted.

Item 3: The majority of people checked the box to have non-skilled jobs be given to citizens in the valley.

U.S. EPA RESPONSE: The agencies will continue to encourage local hiring. However, hiring for the cleanup will be the decision of the private companies.

Item 4: The majority of people checked the box to have an option of removing and replacing carpets and thorough vacuuming and shampooing in the interior of every home, school and business within the Site's borders.

U.S. EPA RESPONSE: U.S. EPA recommends that residents continue individual house cleaning efforts while the remedial activities continues at the Site. Special high efficiency vacuum cleaners can be borrowed from the Superfund Project Office in Kellogg to assist in this effort. As stated in the ROD, after the completion of site wide remedial actions all homes with house dust lead concentrations equal to or exceeding 1,000 ppm will have a one-time cleaning of residential interiors. If subsequent interior house dust sampling indicates house dust lead concentrations exceed a site wide average of 500 ppm the need for additional cleaning will be evaluated.

Item 5: Half of the people checked the box to have a community relations person from the Site to work with individuals and the agency people living and/or working at the Site.

U.S. EPA RESPONSE: The agencies are committed to working with individuals from the effected communities. In addition to a Community Relations Coordinator with U.S. EPA, who can be reached toll free at 1-800-424-4372, there is also a Superfund Project Office in Kellogg for concerned citizens to speak with one of the project managers. Panhandle Health District is available in the local area to address health concerns related to the Site.

Item 6: Over half the people checked the box to have ground water testing and monitoring continue until it is determined that contamination is not a problem.

U.S. EPA RESPONSE: Ground water monitoring is part of the ROD.

Item 7: Approximately half of the people checked the box to have a continual monitoring of the leaching of hazardous waste buried at the Site and immediate remediation at any time a problem arises as long as the waste remains at the Site.

U.S. EPA RESPONSE: Site wide monitoring will be used to evaluate the effectiveness of the selected remedy.

In addition to the survey, several people wrote the following comments:

Comment: Several people commented that they would like to see the Pinehurst Baseball fields tested for contamination. If contaminated, they would like to have the fields remediated.

U.S. EPA RESPONSE: Under Section 9.2.7 of the ROD, buildings and commercial lots within the Site are to be addressed. This will include parks and ball fields.

Comment: Several commentors said they would like Alternative #4 because Alternative #3 would not be protective enough.

U.S. EPA RESPONSE: U.S. EPA has determined that Alternative #3 is sufficiently protective of human health and the environment. While Alternative #4 would have provided some additional remedial actions compared to Alternative #3, U.S. EPA has determined that Alternative #3 will provide comparable net benefits without the increased cost.

Comment: Several commentors said that they would like more information sent to them about the Site. They do not feel that enough information is available.

U.S. EPA RESPONSE: Throughout the process, U.S. EPA has attempted to keep the community informed through regular public Task Force Meetings; and, fact sheets and brochures are available at the Superfund Project Office. A complete Administrative Record of all U.S. EPA response actions at this Site is maintained at the Kellogg Public Library.

Comment: One person would like to see the Task Force "removed".

U.S. EPA RESPONSE: The Task Force was appointed by the County Commissioners in 1985. Because the County Commissioners are locally elected officials, U.S. EPA feels that the Task Force represents the local community. The Task Force is one way in which the community is kept informed.

Comment: A commentor said he thinks that training program and education should be available to train local citizens to work at the cleanup. He also commented that U.S. EPA's information is unreadable and meant to hide the corporation's corruption.

U.S. EPA RESPONSE: Comment Noted.

APPENDIX B

DEPARTMENT OF INTERIOR COMMENTS

August 14, 1992

Mr. Nick Ceto
Remedial Project Manager
Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Ceto:

The Department of the Interior (Department) has reviewed the proposed plan for the Bunker Hill Superfund Site (Remedial Alternatives) and supporting documents including the final Feasibility Study.

The Department remains concerned over the fact that investigations, to date, have focused only on the 21 square mile area referred to as the Bunker Hill Site. So far, little effort has been made to evaluate the extent that contamination has spread from the site to other areas of the Coeur d'Alene Basin. The investigation undertaken, and subsequently the proposed remediation, does not address upstream releases that enter the site or downstream areas where hazardous substances have been deposited. The Department is also concerned that the proposed remediation does not adequately address contamination within the South Fork Coeur d'Alene River (SFCDR) as it flows through the site.

The Department is a trustee for natural resources. As such, it is our responsibility to manage, protect, and restore injured resources under our jurisdiction. Therefore, at issue is whether or not the proposed remediation will in fact protect existing resources and aid in the restoration of injured resources. In as much as the proposed remediation sets aside the issues of contamination entering from upstream, contamination carried by the SFCDR within the site, and the extent of contamination downstream, the Department questions the effectiveness of the proposed remediation. The Department, along with the other natural resource trustees (Coeur d'Alene Tribe and Department of Agriculture), intends to recover natural resource damages to restore the affected areas of the Coeur d'Alene Basin. Continued heavy metal loading in the SFCDR will greatly impair future restoration efforts.

The Department and it's Bureaus stand ready to work with EPA in the remediation process for the Bunker Hill Site. It is also our intention to work aggressively with the Coeur d'Alene Restoration

Project in it's efforts to remediate impacts to the Coeur d'Alene Basin resulting from all releases in the Coeur d'Alene Basin.

Attached are our specific comments relating to the documents we reviewed. If you have any questions please call me at (503) 231-6157.

Sincerely,

Charles S. Polityka
Regional Environmental Officer

Attachment

BUNKER.BLM

Bunker Hill Proposed Plan and Feasibility Report Review Comments

The Proposed Plan and FS do not adequately address downstream and ecological environmental effects. To date significant amounts of hazardous materials are entering and leaving the site and causing effects and long term impacts to downstream areas that are not being addressed by these plans. In the overall analysis of the alternatives (section 9.2.1) the statement that "Both Alternatives 3 and 4 are thought to be fully protective of human health and the environment . . . " (page 9-9), is not consistent with statements in the following section (9.2.2) on ARARs which suggests consideration of waivers because standards can not be met in the ground and surface waters.

U.S. EPA RESPONSE # 1: (a) This ROD addresses contamination within a twenty-one (21) square mile area along Interstate 90 in the Silver Valley area of Northern Idaho as indicated in Figure 1-1 of the ROD. This includes the towns of Pinehurst, Kellogg, Smelterville, and Wardner as well as the Bunker Hill complex. It does not include contamination in the Coeur d'Alene River nor any contamination beyond the indicated twenty-one square mile area.

U.S. EPA has significant discretion in determining the extent of its CERCLA response activities for an NPL Site. The scope of the response activity is to be determined by U.S. EPA during RI/FS. During the RI/FS, U.S. EPA decided to address the significant sources of contamination that exist near and eminate from the towns of Pinehurst, Kellogg, Smelterville, and Wardner as a result of mining operations, including smelting operations, processing plants, and tailings deposition. Remediation of these sources of contamination should reduce contamination entering the Coeur d'Alene River from these sources.

Other contaminated areas within the Coeur d'Alene Basin may be evaluated and addressed separately under CERCLA and/or other statutory mechanisms. A multimedia approach to the Coeur d'Alene Basin is currently being pursued. The NCP makes it clear that U.S. EPA has the discretion to use its authorities under CERCLA, RCRA, CWA, or other authorities to accomplish appropriate cleanup action for releases. 55 Fed.Reg. 9698 (March 8, 1990).

The Coeur d'Alene Basin Project is being designed to integrate and coordinate the activities within the Coeur d'Alene Basin which are being undertaken by the local landowners, local governments, state agencies, the Coeur d'Alene Tribe, the Federal Trustees, and U.S. EPA. This includes coordination of regulatory authorities under the CWA, CERCLA and RCRA. Other state, local, and tribal programs will also be integrated into this Project. The Clean Water Act provides a mechanism for developing water quality standards, evaluating discharge permits and establishing nonpoint source controls within the Coeur d'Alene Basin. CERCLA provides a mechanism for investigation and controlling the release of hazardous substances through the exercise of removal authorities.

(b) Performance standards are designed to ensure that the remedy is protective of human health and the environment and is in compliance with the requirements of Section 121 of CERCLA. The attainment of ARARs will depend in part on the effectiveness of the Coeur d'Alene Basin Restoration activities to reduce or curtail contaminant transport and/or the ability of onsite remedies to meet performance standards over time. ARAR waivers based on technical impracticability will be considered only after review and monitoring of the conditions specified in Section 10.2 of the ROD.

One of the areas that the plan has not sufficiently addressed is high flows and erosion from storm events and spring runoff. Data to address high flows have not been adequately collected nor was a monitoring program established to effectively collect the information during this planning phase. High flow periods cause highly variable and significant loadings to the river and downstream affected areas, but they are not adequately addressed in the plan. The hillside actions of revegetating and terracing are intended to reduce the loadings, but it may take 10 to 12 years for the cover to become effective (page 6-63). It has also been noted that the level of soil contamination appears to be decreasing on the hillsides because of the erosion processes transporting contaminated soil into the surface water systems (page 3-4). Another example is the wetland treatment systems that are being designed to only handle low flows from only two of the draws and that high flows will be bypassed or not treated at all. To address some of the short-term high flow concerns, temporary erosion control measures should be required for all disturbed areas. Idaho's nonpoint Best Management Practices (BMPs) for construction and road activities along with EPA's storm water discharge permitting requirements should be required ARARs for the extensive land disturbing activities that are proposed in the plan. The initial hillside remediation efforts have not been using the erosion control practices that are required for similar land disturbing activities like the road building and forestry practices BMPs, thus erosion problems have been evident in several areas. Erosion control measures, such as temporary vegetation, silt fences, sediment traps can help reduce the sedimentation during high flow events.

Another high flow reduction measure that should be considered is the use of temporary sediment/flow detention basins into which bypass and other high flows could be routed. Such large ponds could be constructed below the mouths of Magnet and Deadwood Gulches; the Central Impoundment Area (CIA); on Smelterville Flats around the wetland treatment pond/airport areas (including the existing pond area by the interchange); the area below Government Gulch; and above and below the Page Pond tailings pile. These areas could be used while the plan is being implemented and the hillside revegetation is being established. These ponds could also be incorporated into the design of the control and bypass features of the wetland treatment ponds to stabilize and control the flows and loadings into that system.

U.S. EPA RESPONSE # 2: U.S. EPA is working with the USDA Soil Conservation Service to identify Best Management Practices to control erosion and sedimentation from Hillsides areas. BMPs being implemented by the PRPs include sedimentation basins, vegetation in critically eroding areas, reforestation efforts, and selected temporary erosion control methods.

These and other erosion control practices are integral components of Hillside response actions.

Storm water management during implementation of selected Remedial Actions is a component of the ROD. Specific storm water management practices will be developed during RD, consistent with state and federal regulations.

We support the removal of the accessible tailings/jig tailings along the Smelterville Flats floodplain as planned (page 13) thus removing source areas that cause high-flow contaminated sedimentation and long-term leaching to the ground water and river system. More removals of the tailings along the river should be required including those accessible tailings along the river below the Pinehurst Narrows and on the flats within the site. Tailings deposits along the river are usually found at levels above the "Threshold" Soil Concentrations in the health risk reports and they need to addressed and removals done where ever practical. EPA should require the removal of tailing deposits all along the river within the site and should remediate these tailings deposits in the downstream and upstream floodplains. The planned tailings removals at the Smelterville wetlands (page 13) and the West Page Swamps (page 14) are needed to reduce the long term loadings to the ground water and river. We would also recommend additional tailings removals where tailings deposits come in contact with ground and surface water systems. Just covering these tailings areas with soils and rock barriers will do little to reduce the long term leaching to the ground and surface waters.

U.S. EPA RESPONSE # 3: (a) U.S. EPA has selected a remedial action which removes over 108 acres of jig tailings adjacent to the SFCDR for consolidation in the CIA. These tailings are removed to a depth of five feet for construction of the wetlands treatment cells. In addition, extensive areas of jig tailings will be removed for the floodway of the SFCDR during channel rehabilitation and floodway construction. Further, the Residential Soils ROD determined that it was impracticable to remove tailings underneath the residential areas of the Site.

(b) In response to comment that U.S. EPA should require removal of tailings in the upstream and downstream floodplains, such actions are outside the scope of the remedial actions selected in the Record of Decision. For further discussion regarding this matter, please see U.S. EPA RESPONSE 1 above.

An area of concern is the wetland treatment systems being designed to handle only low flows and the question of whether or not they can perform efficiently during high flow periods. These systems are going to be treating less than half the annual flows from the surface sources and even less of the loadings because higher loadings will be bypassed or not intercepted during high flows, especially during spring runoff. The ground water treatment system also will probably be intercepting only a small part of the flow and loading during spring runoff periods, under high flow conditions operating the system effectively will be difficult.

U.S. EPA RESPONSE # 4: The wetlands treatment systems were designed to treat contaminated base flows because the toxicity concerns are greatest under low-flow conditions. Source control actions selected in the ROD are expected to adequately address high-flow contaminant when remedial actions are fully effective. During the implementation period high-flows will be managed by implementation of BMPs developed during Remedial Design.

Tailings will be removed from the floodway of the SFCDR during channel rehabilitation and floodway construction. Further, the Residential Soils ROD determined that it was impracticable to remove 911 tailings underneath the residential areas of the Site.

The performance objectives in Section 2 are so general that it cannot be determined what the standard will be, whether it can be measured, or what degree of success might be expected. The performance objectives (the Remedial Action Objectives (RAOs) and their standards and thresholds) still need to be more specifically stated. Better quantification is needed for the objectives so that the planned action's relative contributions towards meeting the RAOs can be identified.

U.S. EPA RESPONSE # 5: Section 8 of the ROD discusses U.S. EPA's basis for selecting a remedial action for the Site. It offers a comparative analysis of the ability of each Alternative to meet and establish cleanup objectives established during development of the FS.

With the uncertainties within the plan and the base information, monitoring of the effectiveness of the planned actions needs to be done in a very specific and organized manner. Monitoring of the water quality effects must be done, especially in the river system, in order to evaluate how the plan is working within the site and potential effects on downstream receptors. We want to assist in the development of the needed water and vegetative monitoring and want to review and analyze the monitoring data as they become available.

U.S. EPA RESPONSE # 6: We agree that monitoring plans need to be more specific. Extensive monitoring of soil, water, and air will be an important component of the remedial actions outlined in the ROD. U.S. EPA will work with DOI during RD/RA to ensure this.

Another area of interest is the effective disposition of site materials and capping of the hazardous materials at the Lead Smelter closure, Zinc Plant closure, and CIA to ensure that potential releases to ground water and offsite are minimized. It is important that materials being disposed of from these sites are properly accounted for, checked, and characterized. We would expect that the materials would be checked and handled to the standards of RCRA characteristic wastes along with the Proposed Plan's proposed ARAR on page 10 and using the RCRA requirements proposed on page 15. The closures using RCRA caps with hydraulic conductivity of 10-7 cm/sec (page 15) is an important requirement and should be required for the CIA (not 10-6 to 10-7 cm/day range stated on page 14). Information in the water quality memorandum indicates the pre-remediation CIA annual infiltration rate is 60 percent (18.2 inches) and a 10-6 cm/sec cover would reduce it to 24.2 percent (7.35 inches), but a 10-7 cm/sec cap would reduce it to 3.3 percent (1.0 inches). We believe that this is an important reduction (especially since the CIA seeps are a 680 lb/day loading source) and that 10-7 cm/day should be required by the plan. We disagree with the PRPs' response in the FS Executive Summary to agency comment (volume II) number 225 on page 28 that the 10-7 cap is not appropriate because it is more protective than Idaho normal tailings pile closure requirements. This is a Superfund Site along a water quality limited stream segment where more than normal Best Management Practices should be required.

U.S. EPA RESPONSE # 7: We agree with the technical analysis. Mitigating factors that support 10^{-6} are: (1) the wastes from 1982 smelter cleanup which were deposited in the CIA will be removed from the CIA, treated (if a principal threat) and disposed of under the lead or zinc plant closures; (2) the original evaluation of the CIA seepage included the presence of a 50 acre tailings pond on top - this is being eliminated and will result in a reduction of the seepage rate and volume; (3) there has been extensive community comment in support of maintaining open space or similar uses for the CIA. A 10^{-7} cap would likely require greater restrictions on future use.

As estimated in the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4, effective loadings from the CIA east cell are expected to be decreased to less than 10 lb/day under Alternative 3 using a $1x10^{-6}$ cm/sec cover. Use of a $1x10^{-7}$ cm/sec cover is estimated to provide an additional reduction of only a few pounds per day at an inordinately greater expense. It should be noted that collection and treatment of CIA seeps is included in the ROD.

The Feasibility Study information is hard to track and it is difficult to find enough detail to understand what is actually planned, and what the expected performance level and expected results and impacts might be. The alternatives are limited and do not give a good comparative range of options. For example, the hillside actions are basically the same for all alternatives (although a very limited alternative B of "spot revegetation" was added). Also in the hillsides sections the Proposed Plan says that "spot revegetation within the 50-85 percent cover class zones" will be done as part of alternatives 3 and 4. In the FS this is indicated in Table 7.2-1b, but in Table 7.2-1a and in sections 7.2.4.1 and 7.2.5.1 it is only indicated in alternative 4.

The hillside alternative development in 6.5.1 is still very limited. It does not present the range of different things that could be done such as varying the intensity of the effort to reduce the risks. Maintenance and monitoring of revegetation success for only two growing seasons after completion of planting and seeding is inadequate, when it is designed to take 8 to 12 years to reach the cover goals. Maintenance and monitoring should be continued until the cover goals are fully met. We recommend stocking/survival surveys at the fifth year after planting, similar to that which BLM does on their tree planting areas. As the hillside revegetation test plots are evaluated, we want to be involved in the evaluations of the study results and the discussions of possible modifications of the reclamation efforts. We expect more extensive planting efforts could be needed to stabilize the hillsides and stream zones and accomplish the RAOs.

U.S. EPA RESPONSE # 8: Those comments have been considered in the development of hillsides remedial actions outlined in the ROD in Section 9.2.1. U.S. EPA expects BLM will continue to provide technical assistance during future hillside activities.

The past concerns about costs presentations in section 5 were improved, but the revised Appendix K is as difficult to find and relate to actions as before. For example, the hillside costs do not appear in the tables because they are part of the hillsides order's costs, but those costs should have been summarized in Appendix K or section 8.3.5. Without the cost information it is difficult to do comparative analyses or to propose other possible cost-effective options.

U.S. EPA RESPONSE # 9: Costs were not included because they were a part of an on-going action. All alternatives, including the no-action alternative, require compliance with existing orders. The Hillside Order is such and order.

The analyses in Section 8 are very general and need more quantified levels and estimates. The results from the water quality memorandum need to be summarized and presented in the FS sections and not by just referring the reader to another document. The treatment of downstream potential effects and benefits should be addressed in a more detailed and realistic manner. If there is a concern about future fishing in the area and a need for institutional controls on ingestion (page 8-14), there should be support for concerns about the present conditions and fishing downstream. Based on the way the alternatives have been developed and considering other actions for water quality improvement, including treatments of high flows that could be completed, it is not appropriate to say that Alternative 4 "provides the largest practicable improvement in water quality and aquatic conditions" on page 8-31. There are no planned actions other than revegetation to address the hillsides areas where soil levels are above the ecological risk levels given in Tables 2.1-1a or 1b. The ecological risks from contaminated soils were not well addressed in the technology and alternative development and need to be looked at and discussed further.

U.S. EPA RESPONSE # 10: The documentation in the Administrative Record is sufficient to support the selection of the remedial actions. Due to the large areal extent and multiple subareas addressed by this action, the supporting documents in the Administrative Record are voluminous. The index and cross referencing tables for the Administrative Record are sufficient for the task of finding specific technical information.

With respect to the down stream effects please see U.S. EPA RESPONSE 1 above.

Both Alternatives 3 and 4 include extensive use of Best Management Practices to control contaminant transport during high-flows. As noted earlier, storm water run-off control and source controls are an important component of Alternative 3.

Regarding the comment that ecological risks from contaminated soils were not well addressed, institutional controls are more effective in controlling human exposure to environmental contaminants than in controlling exposure of ecological receptors. However, many potential exposures of ecological receptors are not currently occurring due to lack of habitat and it is believed that as habitat is established across broad areas of the hillsides and Smelterville flats (much of which has been regraded, or will be capped as part of the selected remedy) that actual impact will be limited. Nonetheless, the preferred alternative calls for biomonitoring (?) of sensitive species to verify that projection. The reader is also referred to the considerable success of the Hillsides Revegetation and Stabilization program in re-introducing vegetative cover in some of the most severely impacted soils onsite.

The Rights-of-Way Sections 3.11.2 and 3.12.2 have drainage/erosion controls listed (item 4) in the general response action part, but then the potentially applicable technologies in 3.11.3 and 3.12.3 are not identified and carried through the process (Sections 4 through 7). This is an important source to surface waters and fugitive dust, and is not covered in this part, or the hillsides, air, or surface water parts adequately. Good drainage design and erosion control features need to be added in maintaining, restoring, closing or building the roads. The drainage improvements which have been made on the Ski Hill road are a good example of what can and should be done. The secondary access roads category should include all the other roads in the area that have not been completely closed. Many are used for various access purposes which add to the dust and water problems on the site and will continue to do so unless addressed as part of this plan.

U.S. EPA RESPONSE # 11: Due to the variability of rights-of-way, management practices for specific rights-of-way will be developed during remedial design.

Post Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4 (Technical Memorandum)

The base data, analyses and results presented do not adequately describe the potential effects and should not be used to justify potential waivers of ARARs. The analytical model using the calibration correction factors as discussed in Section 2.3 give questionable values. For example, in the discussion of the onsite low flow reductions of the alternatives, the site contributions of 71 lb/day and 80 percent decrease for alternative 2 (page 44); of 11 lb/day and 97 percent for 3; and of 10 lb/day and 98 percent for 4 are not logical and show that the model results are very questionable. The onsite loading reductions given in the table on page 74 with the respective percent reductions of 75, 81 and 83 might be more realistic. The onsite loading assumption of 350 lb/day, in part used to develop the calibration factors, is questionable because the results from the draft 1991 low flow sampling indicate the onsite loading could be twice that value. The 1991 low flow onsite loadings for zinc are given as 672 lb/day inflow at SF-2 and 1369 lb/day outflow at SF-8 as compared to the RI/FS values (Figure 2-2) of 630 lb/day inflow and 960 lb/day outflow.

U.S. EPA RESPONSE # 12: (a) The remedy selected by the ROD is anticipated to meet surface water ARARs within the remediated areas. The remedy selected by the ROD also strives to meet ARARs for the ground water within the remediate areas.

Based on information obtained during the Remedial Investigation and the analysis of remedial alternatives, U.S. EPA and the state of Idaho believe that the selected remedy may be able to achieve the water quality improvement objectives stated above. However, ultimate attainment of Federal Drinking Water Standards (DWS) in the valley aquifier system will in part depend upon the sucess of upstream water quality improvement initiatives in controlling contaminant loading to the valley aquifier system, as well as onsite actions. Ground water contamination may be especially persistent in the immediate vicinity of contaminant sources, and in portions of the valley aquifier system most strongly influenced by upgradient surface and ground water contamination.

The ability to achieve cleanup goals (DWS, ARARs, and protection of surface water quality) at all points throughout the valley aquifier system cannot be determined until the remedial actions outlined in this ROD have been effective in meeting their individual performance standards (specified in Section 9), and upgradient efforts to improve water quality have been implemented. If the selected remedy cannot meet DWS throughout the valley aquifier system, notwithstanding upgradient efforts that may be implemented independently of the CERCLA action to improve ground water quality entering the site, the contingency measures described in this section may replace the selected remedy and ground water cleanup goals. These contingency measures will include refinement of ground water recovery and treatment system components of the remedial action, and continuation of institutional controls.

If it is determined, based on the successful implementation of the selected remedy, and contingency measures, that certain areas of the valley aquifier system cannot be expected to *meet ARARs, notwithstanding whatever additional efforts which may be made, independently of this CERCLA action, to improve upgradient ground water quality entering thie site, than a chemical specific ARAR will be waived for the cleanup of those portions of the valley aquifier system not meeting the ARARs.*

(b) The Post-Remediation Water Quality Tech Memo document provides two alternative analyses of load reduction. Both are realistic representations of expected water quality improvements based on the extensive RI/FS data. The probable effectiveness of the remedial alternatives will be better characterized during remedial design. However, the important aspect of both alternative load reduction analyses is that they provide realistic relative comparisons of the proposed alternatives and that each of these remedies are expected to provide significant water quality improvements.

The comment describes an "onsite loading assumption of 350 lb/day, in part used to develop the calibration factor...". The cited loading is actually an <u>unaccounted decrease</u> in loading necessary to balance the loading analysis provided in the RI (see Figure A-3 in Appendix A to the FS). This factor indicates that the sum of the estimated inflows during 1987 low-flow conditions to the site ground water system exceeded the sum of estimated outflows, implying attenuation within the site and/or overestimation of the source terms. Therefore, the statement that "the draft 1991 low flow sampling indicate that the onsite loadings could be twice that value" is illogical. The loading balance provided in the RI is based on instantaneous data collected during 1987. That flow rates and loadings in the SFCDR at the site boundaries are somewhat different during 1991 is expected.

The high flow analysis assumptions and using the results of the low flow model also are questionable. The high flow analysis needs to examine the reasons for the significant increases in loadings that are related to the sediment, interflow, and recharge relationships.

U.S. EPA RESPONSE # 13: Best professional judgement was used in developing high-flow analysis.

An ongoing monitoring program needs to be established and continued throughout the project to obtain the key and significant flow and loading data which the model analysis can assist in determining.

U.S. EPA RESPONSE # 14: Monitoring data is currently being collected under the 1991/1992 AOCs. Selected remedial actions include site wide chemical, physical, and biological monitoring.

BUNKER.FWS

The Proposed Plan for the Bunker Hill Superfund Site, June 12, 1992

The proposed plan is confined to a small fraction of the contaminated area. We continue to recommend that the remediation area and proposed plan be redefined to include remediation of the thousands of acres of wildlife habitats where hazardous substances linked with the site have been deposited.

U.S. EPA RESPONSE # 15: See U.S. EPA RESPONSE 1(a) above.

The following comments and recommendations address only the remediation alternative for the proposed plan on the 21-square-mile Bunker Hill Superfund Site.

The Preferred Alternative 3 and the other defined alternatives in the proposed plan do not adequately address downstream environmental impacts. All alternatives discussed would continue to allow large metals loads to exit the 21-square-mile site. Based on available metals loading information in the Remedial Investigation/Feasibility Study (RI/FS) and data presented below, approximately half the annual metals load measured at Pinehurst (SF 8 or the downstream site boundary) is being released from within the 21-square-mile site. Alternatives should be developed and selected based upon their capability to contain and permanently isolate loads of various metals on the site.

U.S. EPA RESPONSE # 16: The remedial actions selected in the ROD offer substantial reductions of onsite contaminant loading. As stated on Page 57 of the Post-Remediation Water Quality Tech Memo, the remedial actions in Alternative 3 are projected to result in a 97% decrease in onsite loading entering SFCDR at SF7 during base flow. High-flow contaminant runoff will be managed by a combination of source control and source containment.

Complete removal of source materials was rejected in the Residential Soils ROD, and was also screened out of the Non-populated Areas FS as technically impracticable.

We support conventional water treatment technologies because of their proven records of effectiveness. As presently proposed, the plan would allow hundreds of pounds of metals per day to be released from the site while experimentation with unproven wetlands methodology continued for an undefined period.

U.S. EPA RESPONSE # 17: Wetlands treatment was identified in the FS and Proposed Plan for several reasons discussed in those documents. As stated in the ROD, should the Constructed Wetland Treatment Systems not meet either percent reduction criteria and water

quality based effluent limits meeting the substantive requirement of an NPDES permit, pretreatment of influent contaminant streams or modifications to the treatment systems will be required.

The Service could support an alternative set of onsite remedies which would:

1. Collect and conventionally treat all ground water exiting the 21-square-mile site to the best available technology;

2. Collect, detain and conventionally treat all surface flows (low, high and runoff) from Government Gulch, Milo Creek, Bunker Creek and mine shaft effluent(s) to the best available technology; and,

3. Remediate all jig tailings in the 21-square-mile site which are subject to mobilization at any time in the future through stream erosion.

4. We recommend expansion of the detention basin to handle low flows, high flows and runoff flows in the vicinity of Government Gulch, Milo Creek, and Bunker Creek, plus all the ground water and mine discharge water which can be collected in the 21-square-mile site. A detention basin would serve to regulate flows through a conventional treatment facility and possibly be followed by a wetland treatment facility which could be added to polish effluent and possibly reduce operating costs depending upon its proven performance.

The above would constitute a complete water treatment project with contingency capability, guided by discharge performance standards, consistent with the position of overall basin cleanup.

The above remedies superimposed on Alternative 4 would be consistent with the Applicable or Relevant and Appropriate Requirements (ARAR's) and Remedial Action Objectives (RAO's) identified in Feasibility Study (FS) sections 2 and 6.

U.S. EPA RESPONSE # 18: The selected remedy, Alternative #3, will adequately address the problems posed by the Site. Several of the technologies suggested above were screened out during the FS process due to their technical impracticability. For example, collection and treatment of all ground water is not possible.

It would be useful to describe how the RAO's are defined. The RAO's adequate to protect beneficial aquatic uses and biota native to the South Fork Coeur d'Alene River (SFCDR) should be achieved by the plan ultimately selected.

U.S. EPA RESPONSE # 19: As stated in the FS, RAOs for aquatic life protection are based on Federal Water Quality Criteria (FWQC). As noted in U.S. EPA response 16, Alternative

3 would result in 97% reduction of combined metals loading at low flow. These reductions are expected to provide significant benefit to aquatic biota. The Coeur d'Alene Basin Restoration Project is expected to provide additional benefits.

Several proposed remedial actions call for capping of sites with clean soils. It would be useful to describe the source(s) of these materials since other offsite surface disturbing impacts may be associated with this action.

U.S. EPA RESPONSE # 20: Sources of materials will be determined during RD/RA.

What is meant by "sensitive populations" in the last paragraph on page 16 (Commercial Buildings and Lots)?

U.S. EPA RESPONSE # 21: Young children and pregnant women are the categorized sensitive populations.

Bunker Hill Superfund Site Feasibility Study Report, Final, May 1, 1992

On pages 1-2, 2nd paragraph, the RI/FS clearly states that releases contributed to the contamination of soils, surface water, ground water, and air downgradient of the Bunker Hill Superfund Site. However, the remainder of this FS ignores the extensive downgradient area, which includes thousands of acres of wildlife habitat where hazardous substances have been deposited.

RAOs and ARARs must be established with recognition of fish, wildlife and other values throughout the basin where hazardous substances released by the PRPs' have been deposited. Federal Water Quality Criteria (FWQC) should be recognized as an ARAR throughout the area. Sets of ARAR's should be developed for contaminated sediments in all types of wildlife habitat in and below the current site boundaries. An incomplete set of ARAR's is presently being used to evaluate alternatives; thus, an alternative may be selected which is not stringent enough to meet FWQC and sediment ARAR's below the site regardless of all possible remediation actions for other areas above and below this site.

U.S. EPA RESPONSE # 22: Please refer to U.S. EPA RESPONSE 1(a).

Throughout the FS and related documents, comparisons are made to existing contaminated conditions. A logical basis for comparison would be conditions which are believed to have existed prior to mining.

U.S. EPA RESPONSE # 23: The comparison of alternatives in the FS as required by the National Contingency Plan is always made against a baseline "No Action" alternative which reflects the existing conditions.

Because significant Federal Trust responsibilities exist within the site and throughout the Coeur d'Alene River basin, we recommend that decision makers be provided with concise estimates of the reductions in metal loads and related concentrations exiting the 21-square-mile site as a result of proposed remedial actions. We recommend a new alterative be defined, based on the best available technology to achieve the RAO's and ARAR's. In addition, the metal loads contained on and released from the site should be estimated both for the near term and at a future design point of 50 or 100 years. Using this approach the effectiveness of various remediation plans could be evaluated over time.

U.S. EPA RESPONSE # 24: The Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4, which was prepared as a companion document to the FS, provides concise estimates of metal loading reductions under the various remedial scenarios. These estimates are based on long-term projections (i.e., several decades after implementation of remedial actions). In general, assessment of short-term loading *reductions with any certainty is not considered to be possible due to the cumulative, and perhaps synergistic effects of multiple remedial actions occurring at various times during a ten-year period. See also U.S. EPA RESPONSE 18 regarding other alternatives.*

The RAO's, ARAR's, and FWQC identified in sections 2 and 6 of the FS would not be fully achieved by Alternatives 2, 3, or 4, as acknowledged in Summary Table 9.1-1 under ". . . compliance with ARAR or justification for waiver." If this is the case, natural resources for which the Department is a trustee will continue to be affected. In contrast, on page 9-9 it is stated that "Both Alternatives 3 and 4 are thought to be fully protective of human health and the environment through large improvements in all site conditions." Our review of the FS, particularly of the loadings associated with the constructed wetlands, indicates that most of the combined metals load in the SFCDR exiting the 21-square-mile site will continue to do so in the near term with alternatives 2, 3, or 4, as proposed. Under alternative 3, it appears about 141,255 lb/year of combined metals would be contained while 362,545 lb/year would continue to exit the site via surface or ground water (reference the summary of loads associated with Alternative 3 wetlands treatment). It is important to recognize that only half of the annual metals load measured at the downstream edge of the site originates within the site.

U.S. EPA RESPONSE # 25: Please see U.S. EPA RESPONSE 16 regarding reductions in onsite loadings.

Page 2-23: Reliance on flow data sets which are 25 to 55 percent below average and one "high flow" event could result in large errors throughout the analysis and alternative selection. We suggest that EPA consult with the U.S. Geological Survey (USGS) concerning this aspect of the study.

U.S. EPA RESPONSE # 26: Additional flow data is being collected under the 1991 and 1992 Administrative Orders on Consent. This data will be evaluated during RD/RA.

Page 2-39: Erosion of all jig tailings or contaminated stream banks should be considered per RAO No. 8 on page 2-7 and identified here. This issue has been limited to Smelterville Flats jig tailings.

U.S. EPA RESPONSE # 27: All exposed jig tailings in the stream bank within the Site are addressed in this ROD. Identifiable areas of jig tailings deposition are not present along the SFCDR within Kellogg due to river channelization. However, erodible jig tailings are present along the SFCDR near the north side of the CIA, and throughout Smelterville Flats. Removal or stabilization of jig tailings in these areas is addressed by FS Alternatives 3 and 4. Under Alternative 3, construction of the floodway would involve removal of jig tailings from the SFCDR channel (see Section 6.6.1.3 of the FS).

Page 3-5 through 3-9, Ground Water Loading: These data are presented with a possible error of plus or minus one order of magnitude. Therefore, it appears that major decisions could be made on inaccurate or imprecise data. We recommend that ground water treatment facilities be designed and constructed in order to be capable of functioning effectively during periods of high flow.

U.S. EPA RESPONSE # 28: The ground water flow estimates provided in the FS (pp. 3-7 and 3-8) are considered to be as accurate as possible, due to the uncertainties inherent in estimating aquifer characteristics such as hydraulic conductivity and cross-sectional flow area. Therefore, though uncertainty is present, this uncertainty is not any greater than that associated with any typical ground water investigation. Ongoing data collection will assist in the design of the ground water collection and treatment system. It is our opinion that the ground water flow and loading rates within the Site are adequately known for the purpose of the RI/FS. Treatment of site wide ground water was screened out in the FS.

Page 3-15: From Figure A-3, a total treatable load of 977 lb/day of combined metals exiting the site in ground water from reaches 1, 3, and 5 and the western boundary should be the basis for remedial actions rather than the 657 lb/day net release, identified on Page 3-15. This would better address total metals loading.

U.S. EPA RESPONSE # 29: Components of the proposed alternative (FS Alternative 3) address a large component of this net gain. Contaminant loadings exiting the Site at its west boundary are addressed through source containment/source control actions as well as by the proposed constructed ground water wetland treatment system.

Page 3-16: The document indicates that surface water loading data used in the FS may not be representative. Limited data were gathered under drought conditions. We agree, and in response we have used some new (1991) data to describe our perception of the relative worth of Alternative 3 in containing metals within the site. See our discussion on constructed wetlands below. New, 1992 loading data gathered by the Coeur d'Alene Basin Restoration project should be considered by EPA during alternatives selection.

U.S. EPA RESPONSE # 30: Data in the Administrative Record is sufficient to base decision on selection of alternatives. Additional data being collected will be useful during RD/RA.

Page 5-3: RI/FS guidance does not preclude alternatives which are more expensive and more effective. It appears that some alternatives, considered and disregarded in the FS may rank highly if the decision makers focus on metals load contaminant potential rather than costs. Effective remedial action will best reduce/eliminate impacts to trust resources.

U.S. EPA RESPONSE # 31: Remedial alternatives presented in the FS were developed consistent with the guidance and provide a basis for selecting an alternative that is protective of human health and the environment.

Page 5-39: These ". . . few exceptional . . ." mine dumps contributing to metals loading of the SFCDR should be removed or isolated hydrologically.

U.S. EPA RESPONSE # 32: Under the Hillsides Administrative Order on Consent the mine dumps that have been determined to be contributing loadings to the SFCDR are either removed or hydrologically isolated.

Page 5-47: Jig tailings are an important component of high flow loading to the SFCDR. Jig tailings removal represents a major opportunity to remedy a significant source of metal contamination from the 21-square-mile site. Removal of erodible jig tailings throughout the site should be reconsidered with regard to probable total annual load reduction and implementation of the RAO's.

U.S. EPA RESPONSE # 33: Erodible jig tails from within the 21-square-mile Site are discussed in U.S. EPA RESPONSE 27.

Page 6-6 and 7: Reprocessing should be reconsidered as a permanent remediation measure where metal concentrations are particularly high.

U.S. EPA RESPONSE # 34: Reprocessing is a primary element of Alternative 3. Please refer to the FS.

Page 6-13, Table 6.2-1: Alternatives E and F including valley-wide collection and conventional treatment of ground water would best support the RAO's, etc. These alternatives could treat all metals loads exiting the site (977 lb/day in Figure A-3). This load may be greater in an average hydrologic year. Alternative F with emphasis on source control offers the greatest load reduction.

U.S. EPA RESPONSE # 35: Valley wide collection and conventional treatment of ground water was evaluated and screened out in the FS.

Page 6-30: Alternatives 2, 3 and 4 all fail to address this list of eight primary sources of surface water contamination.

U.S. EPA RESPONSE # 36: Only the first item (flows in the SFCDR across the upstream boundary of the Site) is unaddressed in the FS; however, this item will be addressed under the Coeur d'Alene Basin Restoration Project. Other items are addressed as follows:

1. *Seeps located north of I-90 near the CIA: these seeps would be collected and treated under Alternatives 3 and 4.*

2. *Storm events which mobilize contaminants in the Government Gulch, Magnet Gulch, and Bunker Creek drainages: all alternatives include terracing and revegetation to reduce sediment loadings from these areas. In addition, Alternatives 3 and 4 include large sedimentation basins in the Government Gulch and Bunker Creek drainages.*

3. *Discharge from the Kellogg Tunnel: this source will be treated, either in a CTP or constructed wetland, under Alternatives 2, 3, and 4.*

4. *Ground water discharge to the SFCDR in Pinehurst Narrows and north of the west half of the CIA (this latter reach is the same as the "CIA seeps"): ground water discharge to the SFCDR in Pinehurst Narrows is addressed through a constructed wetland treatment system (Alternative 3) or a conventional pump-and-treat system (Alternative 4). Ground water discharge to the SFCDR in the "CIA seep" area is addressed above.*

5. *Erosion of contaminated sediments from stream banks: this source is addressed through SFCDR channelization (Alternative 2), SFCDR floodway construction (Alternative 3), and removal of accessible jig tailings (Alternative 4).*

6. *Erosion and transport of contaminants from hillside areas is addressed by terracing and revegetation under all prescribed alternatives.*

7. *Potential discharges through the Reed Tunnel to Milo Creek as a result of the closure of the Bunker Hill Mine: the 1991 Smelter Complex Unilateral Order requires the development and implementation of a mine closure plan.*

Page 6-33, Table 6.3-1, Enhancement of wetlands in Page Swamps: Unless it can be demonstrated that these wetlands would be maintained with metals concentrations protective of fish and wildlife (including their propagation), we recommend that they be eliminated and mitigated offsite. Elimination may best be accomplished with ground water collection systems E and F, described on page 6-13, which could simultaneously collect the incoming surface water.

U.S. EPA RESPONSE # 37: U.S. EPA has entered into an Interagency Agreement with the U.S. Department of Interior to assist in developing appropriate management strategies for West Page Swamp.

Page 6-37: Alternative D offers the greatest benefit in metal retention capability within the site. However, Alternative D should be amended to treat high surface flows with expanded treatment and detention ponds.

U.S. EPA RESPONSE # 38: High flows are addressed through source control and storm water management during remedial actions.

Page 6-67: Alternative E appears to have the greatest benefit of those presented. Erodible jig tailings existing elsewhere along the 7 miles of the SFCDR and its tributaries should also be removed. A new alternative addressing removal of all erodible jig tailings within the site should be evaluated.

U.S. EPA RESPONSE # 39: Alternative E was evaluated in Alternative 4. See U.S. EPA RESPONSE 27 for discussion on jig tailings.

Page 8-5, Table 8.2-0: The volumes of waters treated are minor fractions of the totals exiting the site. Expanded treatment capacity is recommended.

U.S. EPA RESPONSE # 40: See U.S. EPA RESPONSE 4.

Constructed Wetland Treatment Systems for Remediation of Metals in Site Drainage, RI/FS Technical Memorandum May 1, 1992.

As a goal for constructed wetlands, the document states that "Some treatment of residual aqueous contaminants appears necessary to complete the RAO concerning release of metals to the SFCDR." Specific goals are not defined here. Thus, the effectiveness of this phase of the remediation plan cannot be evaluated. However, surface water RAO's in Volume I of the FS, (page 2-29), mandating compliance with FWQC may not be fulfilled with the constructed wetlands treatment system.

U.S. EPA RESPONSE # 41: Section 9.2.1 of the ROD discusses performance requirements of the constructed wetlands. If the wetland systems do not meet percent reduction criteria and water quality based effluent limits meeting the substantive requirements of an NPDES permit, pretreatment of influent contaminant streams or modifications to the treatment systems will be required. See U.S. EPA Response 17.

Data are needed on annual loadings to the SFCDR and concentrations of individual toxic metals in the SFCDR from the site with and without the constructed wetland and conventional treatment systems for both Alternatives 3 and 4. Data and analysis are also needed on the extent of exceedance of FWQC in the SFCDR with Alternatives 3 and 4 and a new remediation alternative using the best available technology. Information is needed on the proposed performance standards the associated beneficial uses, FWQC, and other ARAR's. In the absence of specific goals and a means to evaluate the contribution of the wetlands or conventional treatment alternatives, it is assumed that deficiencies exist. This specific information should be provided and discussed prior to alternative selection and detailed design of water treatment facilities.

U.S. EPA RESPONSE # 42: There is sufficient information in the Administrative Record to support the selection of remedial alternatives, including the wetlands treatment systems. Post Remediation Water Quality Tech Memo provides detailed information on the effectiveness of Alternatives 3 and 4 in meeting Federal Water Quality Criteria. It is expected that additional data will be collected during RD/RA that will assist in the design, construction, operation and performance of the treatment system.

From the Clean Water Act Section 404 regulatory program, we know that nationally only about half the wetlands mitigation sites are functioning as planned. This wetland plan, claiming 90 percent removal of various metals from the portion of water being treated, is developed from a series of bench and pilot-scale studies with effluent volumes averaging less than 2 percent of the proposed project and with a variety of other metals and physical conditions. In this plan it is assumed that cattails (Typha sp.) will eventually cover the wetland cells. Service observation of shallow wetlands in the lower SFCDR basin, heavily contaminated with these same mine wastes, indicate that cattails are uncommon and horsetail (Equisetum) sp. tends to dominate the emergent vegetation. During the last 10 years a few small stands of cattail have become established in Bare Marsh. Establishment and maintenance of a uniform stand of cattails over these wetland treatment cells may not be feasible. Other plants such as horsetail may serve this need.

EPA RESPONSE # 43: U.S. EPA will consult with USFWS during RD/RA to address this issue. While it is true that wetland mitigation projects have had mixed success, this has been due commonly to poor planning and poor understanding of the physical/chemical/biological relationships required to develop effective metals remediation. The observation of marginal or no performance in poorly designed systems demonstrates the importance of proper design and construction, but is not indicative of the potential success of the constructed wetland treatment systems being carefully designed for Smelterville Flats.

To provide organic carbon and nutrients, the addition of domestic sewage is proposed. The effect of the nutrients nitrogen and phosphorus on the metal stability in the sediments of Lake Coeur d'Alene, should be considered. We acknowledge that the various proposed metal removal remedies within the 21-square-mile site would, over time, reduce loading to the SFCDR; loading would in the absence of treatment, be gradually reduced over time, because mining has ceased and metals are continuously being flushed off the site. It should be recognized by EPA that most surface and ground water exiting the site would never be treated in the constructed wetlands proposed in Alternative 3 (Table 1). Metals in this untreated water are generally not permanently removed by the proposed source control remedies. These source control measures, as proposed, may reduce high flow load to the SFCDR, but there is virtually no information to evaluate high flow loading (Table 1). Hillside revegetation may affect the rate but not the long-term total load of metals exiting the site. Much of the erodible jig tailings along 36,000 + feet of SFCDR and other tributaries is not proposed to be removed.

U.S. EPA RESPONSE # 44: The selected remedy adequately addresses metal loadings from the Site to the SFCDR including erodible jig tailings as discussed in U.S. EPA RESPONSE 27. The possible use of municipal effluent as a source of organic material to the wetland would likely result in a net decrease in available nutrients to the SFCDR.

Table 1: Estimated near-term site loading to the SFCDR at Station SF 8, including ground water site outflow, without and with the Alternative 3 constructed wetlands.

	Daily load	Annual load
Without---	Low flow 704 lb/day x 245 days [a]	172,480 lbs
	High flow 2,761 lb/day x 120 days	331,320 lbs
	Total	503,800 lbs
With---	Above total minus 387 lb/day (430 lb/day-x 90 percent removal) x 365 days	141,255 lbs
Difference		362,545 lbs

[a] From page 92 of the Post-Remediation Water Quality Projections for FS Alternatives 2, 3 and 4.

In the near term, we may expect the continued release of 362,545 lb/year as combined metals from the entire 21-square-mile site, while up to 141,255 lb (28 percent of the total) is retained in the proposed wetlands.

U.S. EPA RESPONSE # 45: It is clear that the intensive source-control efforts of Alternative 3 are ignored in the analysis. The constructed wetland treatment systems are not intended as the primary mitigative measures under this alternative. Rather, they are ancillary measures intended to complement intensive source-control measures to form a comprehensive and integrated remedial program.

Surface Flows Treated

The constructed wetlands proposed in the document will be subject to front-end clogging with suspended solids (page 49). High flows coming off barren hillsides characteristically carry suspended solids. High surface flows of Bunker Creek and Government Gulch would be diverted to prevent the inflow of suspended solids and would not be able to enter the constructed wetlands for treatment. From the FS and associated documents, we have estimated that the following surface flows would actually be treated under Alternative 3:

A. Bunker Creek would be limited to 3.41 cfs (Table 9) including Kellogg Tunnel discharge (Page 45) which is now about 1.0 cfs. This is consistent with the 2.39-cfs low flow discharge in Figure A-3 in the FS Appendices. The September 1987 combined metals low flow load was 2.5 lb/day (page 3-16).

B. Government Gulch would be limited to 1.12 cfs (Table 9) including O.3 cfs of ground water (Page 45 and Figure 1-3 of the FS Appendices). Surface flows above 0.82 cfs would be diverted away from constructed wetlands because of sediment loading. The September 1987 low-flow, combined metal load for Government Gulch was 8.2 lb/day (page 3-16 of the FS).

In comparing the diversion threshold flows for Bunker Creek and Government Gulch, (2.39 and 0.82 cfs, respectively) with actual flows in 1985 and 1986, we find that 73 percent of the combined flows are untreated high flows (Table 2).

Table 2. Surface water flows <u>1985-1986</u> Compared to design flows allowed to enter the collected water treatment system (Data from 1987 RI/FS Workplan).

Month	Discharge, Bunker Creek CFS	Discharge Not Treated Over 2.39 CFS	Discharge, Govt Gulch CFS	Discharge Not Treated Over 0.82 CFS
January 85	4.4	2.01	1.4	0.58
February	5.2	2.81	0.8	0.00
March	11.0	8.61	3.0	2.18
April	13.4	11.01	14.0	13.18
May	5.2	2.81	6.4	5.58
June	10.6	8.21	2.5	1.68
July	3.8	1.41	0.2	0.00
August	5.8	3.41	0.3	0.00
September	5.4	3.01	0.4	0.00
October	4.9	2.51	0.5	0.00
November	12.0	9.61	3.2	2.38
December	7.6	5.21	1.3	0.48
January 86	9.0	6.61	2.4	1.58
February	19.2	16.81	8.8	7.98
March	15.0	12.61	5.8	4.98
April	8.2	5.81	3.6	2.78
May	7.8	5.41	3.4	2.58
June	4.4	2.01	1.2	0.38
July	3.9	1.51	0.8	0.00
Average	8.25	5.86	3.16	2.44
Percent of discharge Not Treated		71.0		77.0

From Table 5.1 of the Ecological Risk Assessment and the McCully, Frick and Gilman data for March 24, 1991, we see that relatively low loads of combined metals exit the 21-square-mile site under low flow conditions. As part of the RI, surface waters were collected from August 1987 through October 1988 during a period when surface flows were ". . . approximately 25 to 55 percent below average" (page 2-23, FS). From this sampling, combined metal loads of four instantaneous surface samplings of Bunker Creek and Government Gulch are the apparent basis for much of the FS analyses. These data are found in the FS on page 3-16 and in the RI on page 5-81 (Table 3).

Table 3: Partial surface water metal loadings from the 21 square mile site.

	Low Flow September 1987		High Flow April 1988	
	Flow	Load	Flow	Load
Bunker Creek	2.39 cfs	2.5 lb/day	Not Reported	68 lb/day
Government Gulch	0.14 cfs	8.2 lb/day	Not Reported	100 lb/day
TOTAL		10.7 lb/day		168 lb/day

(1) The constructed wetlands would receive about 29 percent of the surface flows in Bunker Creek and 23 percent of the surface flows in Government Gulch (Table 2)

(2) The 1985-1986 flows were largely (71 and 77 percent respectively) in excess of the intake bypass thresholds designed to exclude suspended solids.

(3) In Bunker Creek, all non-drought-year flows would be considered high (in excess of the 2.39-cfs diversion threshold) and wouid be most closely represented by the 68 lb/day high-flow estimate because all 1985-1986 flows were greater than the low-flow loading data points from the drought of September 1987.

(4) Most of the flow (71 percent) of Bunker Creek would go untreated, allowing 48 lb/day to exit the 21-square-mile site directly; 20 lb/day would be treated.

(5) Like Bunker Creek, all flows in Government Gulch exceed the September 1987 data-point flow, and average loads carried by Government Gulch approximate 100 lb/day of combined metals. Seventy-Seven percent of the flow would be untreated for an approximate release of 77 pounds per day from the 21-square-mile site, 23 lb/day would enter the constructed

wetlands for treatment. A total of 43 lb/day of combined metals in surface waters from the two creeks would be treated in the constructed wetlands, while 125 lb/day would enter the SFCDR untreated. Using 90 percent treatment efficiency (the examples presented could also support an efficiency of less than 50 percent), another 4 lb/day would be released to the SFCDR. Overall, the constructed wetlands would remove about 39 lb/day of combined metals, while about 129 lb/day would continue to enter the SFCDR for a maximum combined removal efficiency of about 23 percent for surface waters of Bunker Creek and Government Gulch.

U.S. EPA RESPONSE # 46: The thesis that only a small portion of combined metals loadings from the Site is "treated" by proposed remedial actions is flawed by its lack of consideration of complementary source control actions that will be implemented under Alternative 3. The analysis of water quality conditions subsequent to successful implementation of remedial actions under low flow conditions is appropriate, particularly given the extensive benefits that will be realized during high flow events due to source control actions. Treatment of surface water and ground water is intended to complement source control measures and address residual contamination entering the SFCDR that will not effectively be mitigated by source control measures alone.

Ground Water Treatment

The potential effectiveness of constructed wetlands in treatment of ground water should be compared to best available technologies applied to the total load of combined metals discharging to the SFCDR or otherwise exiting the 21-square-mile site. From Figure A-3 in the FS, this total load of combined metals exiting the 21-square-mile site is 977 lb/day. Another 76 lb/day, in ground water entering the site may also be collected for treatment.

U.S. EPA RESPONSE # 47: The constructed wetland treatment systems are not intended to be the sole response actions to ground water and surface water contamination. These systems are intended to compliment other source control and source containment actions. All of the response actions in the selected remedy together provide the best available technology for remediation of the Site.

The additional loadings entering the Site should be addressed under the Coeur d'Alene Basin Restoration Project. Please see U.S. EPA RESPONSE 1(a) for further discussion.

From Table 9 of the Constructed Wetlands Treatment Technical Memorandum, 75 percent of the flow with its combined metals load, or 338 lb/day, would be collected for treatment in Reach 3. From Figure A-3 of the FS a total of 20.9 cfs containing 440 lb/day of combined metals exits Reach 5 via the SFCDR or through contaminated floodplain soils at the site's western boundary. Eleven percent (2.29-cfs design intake divided by 20.9 cfs) (Table 9) of this Reach - 5 discharge water would be collected for treatment. Eleven percent of 440 lb/day is 48 lb/day, but it is claimed in Table 9 that 309 lb/day would be in some way captured from this 11 percent of the Reach-5 ground water discharge actually treated. We disagree.

U.S. EPA RESPONSE # 48: For the above estimates to be true, a fully uniform distribution of metals concentrations would have to be present in the SFCDR, the upper zone, and the lower zone near the west site boundary (i.e., concentrations in each of these media would have to be equal). However, based on RI data, there are large intra- and inter-medium variations in water quality. For example, zinc concentrations in the upper zone near the center of the proposed ground water wetland were measured at 35.7 to 47.7 mg/L during the RI (monitoring well GR-27). However, zinc concentrations in the upper zone near the west site boundary ranged from only 0.070 to 0.149 mg/l (monitoring well GR-25), fully two orders of magnitude smaller than those that will be treated by the proposed wetland. These concentration differences account for the apparent discrepancy cited above and emphasize that the proposed remedial actions focus on areas which most urgently require mitigation.

It is unlikely that 70 percent (309 lb of a total of 440 lb/day) of the combined metals load will be collected from only 11 percent of the ground water in the generally contaminated floodplain of Reach 5. If the same logic from Table 9 is applied to Reach 3 it appears that a total of 386 lb/day (338 lb plus 48 lb/day) of combined metals will be collected for wetland treatment from 5.24 cfs of the ground water in Reach 3 and Reach 5. If the total load of combined metals exiting the 21-square-mile site is 977 lb/day (Figure A-3 of the Feasibility Study) this means that 591 lb/day of combined metals would exit the site untreated in ground water.

U.S. EPA RESPONSE # 49: Please see U.S. EPA RESPONSE 48 above.

Some metals load would continue to pass through the wetlands. Of the 386 pounds of combined metals treated, 38 lb/day at the stated 90-percent removal efficiency, up to perhaps 191 lb/day (using 50 percent removal efficiency, which could also be supported by examples in this Technical Memorandum) would continue to exit the site. Therefore, the constructed wetlands may remove between 20 and 35 percent of the combined metals load of 977 lb/day exiting the 21-square-mile site in ground water. This amounts to continued releases between 784 and 630 lb/day of combined metals in ground water from the 21-square-mile site with the proposed constructed wetlands.

U.S. EPA RESPONSE # 50: The above estimates do not account for the intensive source-control measures to be implemented under the selected remedy (Alternative 3). As has been noted previously (see U.S. EPA Response 46), the constructed wetland treatment systems are not intended as the sole mitigative measure under this alternative. Rather, they are ancillary measures intended to complement the intensive source-control measures to form a comprehensive and integrated remedial program.

Kellogg Tunnel

Kellogg tunnel discharge is discussed on page 45 of constructed wetland Technical Memorandum. Discharge from this tunnel may increase. Data are needed on the maximum volume and combined metals load from this source.

U.S. EPA RESPONSE # 51: Under the requirements of the 1991 Smelter Complex Unilateral Administrative Order studies are on-going with respect to mine closure and potential post-closure flow rates which will eventually issue from the Kellogg Tunnel. However, it is unlikely that future passive flow rates from the Kellogg Tunnel will exceed those required to maintain the mine in a dewatered state, as characterized by RI data. During dewatering operations, the area around the mine workings can be characterized a "cone of depression" several thousand feet deep. In other words, the mine workings served as a large scale ground water sink, stressing the bedrock, fracture-flow ground water system. Such stress will be absent upon filling of the mine. Therefore, it appears likely that inflow to the mine after it is full will be smaller than when the mine was dewatered. RI flow rates from the Kellogg Tunnel to the CTP and thence Bunker Creek were utilized to characterize post-remediation conditions for conservatism.

Impacts to Migratory Birds

There is a potential for adverse impacts to migratory birds with the constructed wetlands treatment system. This was previously identified in the January 21, 1992 Department of the Interior comments on the Revised Feasibility Study and associated documents. Injury to migratory birds may occur through metals bioaccumulation in plants, invertebrates, and possibly other organisms which may occur on the site and become incorporated in the food of migratory birds. In addition, there is a possibility of direct sediment ingestion (Blus et al., 1991, Lead Toxicosis in Tundra Swans near a Mining and Smelting Complex in Northern Idaho: Arch. Env. Contam. Toxicol. 21, 549 - 555). Some shore birds are known to consume up to 30 percent of their diet directly as sediments (Unpublished U.S. Fish and Wildlife Service Report, Beyer, Conner and Geruld 1991, cited on page 3-19 of the Ecological Risk Assessment).

If the constructed wetlands function as planned they may over time become the most contaminated wetlands in the Coeur d'Alene basin. It is unclear whether or not cattails or some other vegetation can be maintained on the constructed wetlands; they may support other vegetative species or none at all. The presence or absence of invertebrates and other organisms, which may become involved in bioaccumulation of toxic metals, cannot be reliably predicted.

This potential was previously brought to the attention of the EPA with the expectation that if the constructed wetland alternative is selected, it would include design contingencies to reliably preclude loss or injury to migratory birds. However, the conclusion on page 28 is focused on denial of a potential problem, rather then development of contingency designs.

Adverse impacts to migratory birds can be avoided, and the Service is available to assist EPA.

U.S. EPA RESPONSE # 52: In the Wetlands Tech Memo, it is consistently maintained that one important design feature of the constructed wetland treatment systems proposed for Smelterville Flats is that influent and associated toxic metals will be made to flow through a subsurface, gravel-bed treatment zone that will minimize the potential for direct exposure of vertebrate wildlife to retained metals. Direct ingestion of metal-contaminated sediment would be highly unlikely in the gravel-bed treatment systems. Such systems are very different from natural wetlands occurring down river in which waterfowl mortalities possibly associated with direct sediment-metal ingestion have been reported (Blus et al., 1991).

There are no available field data from wetlands associated with mine drainage sites where increased bioavailability has been found or where significant ecological effects for high-trophic-level consumers (especially vertebrate predators such as fox, mink, or raptors) have been observed for the contaminants of primary concern at the Site (Zn, Cd, Pb, As). U.S. EPA expects to coordinate with the USFWS to mitigate any potential impacts to wildlife.

Deficiencies and unknowns with wetlands treatment include: (1) inability to function with intake of suspended solids, (2) potential iron oxide clogging, (3) temperature control and freezing, (4) disposal of hazardous materials accumulated (RCRA exempt or not), (5) life expectancy, (6) water balance, (7 re-release of metals, (8) incomplete treatment of all surface waters, and (9)increase in plant nutrient discharges.

U.S. EPA RESPONSE # 53: The Wetlands Technical Memorandum has provided general discussion and a large list of references that pertain to most of the issues addressed in this comment. Specifically, numbers 1,2, 5, and 7. The proposed wetlands systems does not contemplate final disposal of metals other than retention in subsurface treatment zones of gravel-bed wetlands. However, long term management of wetland substrate and, operations and management considerations will be an integral part of remedial design. Water balance concerns (#6) are being addressed in the continuing design of the constructed wetlands for Smelterville Flats. Potential increase in plant nutrient discharges (#9) is not expected to cause significant effects in the SFCDR. Although some nitrogen and phosphorus will be released in wetland effluent, the dilution factor in the SFCDR will be great and therefore downstream fertilization is not expected to be significant to the aquatic receiving system. It should be noted also that the current discharge of secondary treated municipal wastewater from two treatment plants occur at the downgradient end of the Site and these loadings will most likely be much more concentrated in nutrients than the discharge from the constructed wetlands. All of these issues will continue to be addressed in remedial design.

Page 86. Reference is made to passive solar heating of 109 acres of exposed wetland in northern Idaho. We question the feasibility of this. If we may expect failure or partial failure of these systems to occur during low temperature and possibly frozen conditions, the expected loss in performance should be calculated and expressed in terms of metal loads which will not be contained and the associated impact on concentrations with regard to exceedance in the SFCDR.

U.S. EPA RESPONSE # 54: As stated on Page 86 this is not being proposed as part of the treatment system design although it could be considered as an option in the future.

Page 87. Both treatment system design and performance monitoring are dependent upon establishing quantitative goals, which include beneficial uses and FWQC for the SFCDR and most significantly the individual metal limits in the related discharge performance standards. This document does not provide sufficient information to make informed decisions on water treatment alternatives within the 21-square-mile site.

U.S. EPA RESPONSE # 55: Although the SFCDR is not being addressed as a part of this remedy, the remedial actions will establish quantitative goals for limiting discharges to the river. As stated in the ROD, it is U.S. EPA's expectation that the wetland system will achieve a minimum of 90% removal efficiency and will meet water quality based effluent limits prior to discharge to the river.

Page 47. It is indicated that the completion of Phase 1 and Phase 2 wetlands is optional. Similarly, on Page 45 the Central Treatment Plant is described as optional. Only treatment facilities actually proposed should be considered in alternative analysis.

U.S. EPA RESPONSE # 56: The ROD will require the Collected Water Wetland occupy 74 acres and the Ground Water Wetland system occupy 34 acres.

Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2,3, and 4, RI/FS Technical Memorandum May 1, 1992.

The alternatives are presented as long-term remediation scenarios. No specific period of analysis is given. These scenarios, including the preferred alternative, provide no way to distinguish between the loads of metals which would be permanently contained as a result of treatment, and long-term diminished loads exiting the site due to a continuation of natural transport mechanisms. Metals removed from the site should clearly be distinguished from those changes which would occur naturally to compare the relative worth of the proposed alternatives. Discharge performance standards should be defined now to direct alternative selection. Performance standards would also be useful in quantifying the true contribution of remediation alternatives. The extent of metals loads which continue to exit under all possible alternatives should be developed prior to alternative selection.

*U.S. EPA RESPONSE # 57: **Without implementation of source control measures proposed under the selected remedy long-term reductions in loadings leaving the Site are expected to be small. Without these source control measures, various contaminant sources will continue to leach heavy metals to the ground and surface water systems. In general, accurate characterization of the length of time required for full realization of remedial benefit is not considered possible. Similarly, accurate characterization of metals removed from the Site versus those changes that would occur naturally is not considered possible. These difficulties, and the estimated extent of metals loadings exiting the Site under the three prescribed action-based alternatives are described in the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4.***

Regarding the comment about the use of performance standards, as noted on page 2 of the Post Remediation Water Quality Tech Memo, the water quality projections provided were only considered valid for purposes of comparing remedial benefit between the proposed alternatives.

Page 10: The low-flow loading estimate in May 1991 by McCully, Frick and Gilman, Inc. of 704 lb/day at Station SF 8 does not support removal of the excess loadings or ". . . cumulative difference loads. . ." from the loading balance, Figure 2-2.

*U.S. EPA RESPONSE # 58: **The cumulative difference term shown on the RI loading balance (Figure 2-2 of the Technical Memorandum) does not represent a removal of loadings. For model credibility, it is necessary for the pre-remediation model to simulate measured flows and concentrations at the western site boundary. The cumulative difference term represents the net difference in estimated loadings entering the Site versus those leaving the Site (i.e., the sum of estimated loadings entering the Site was larger than those estimated to leave the Site). Based on these estimates, overestimation of source terms and/or attenuation of contaminants within the Site is apparent. Ignoring these factors for the water quality projections would have resulted in non-simulation of measured concentrations at the west site***

boundary under the pre-remediation scenario, thereby introducing additional uncertainty into the results. Also, this term is associated with an instantaneous loading balance based on RI data; it is highly probable that the term would be different for a data set from another year.

Page 21: Remarkably little high-flow loading data were obtained during the RI/FS. Some May 1991 high-flow, metals loading data, apparently not used in the RI/FS, are provided below, Table 4.

Table 4. Low and high flow combined metals loads exiting (discharging from) the 21-square-mile Bunker Hill Superfund Site via the SFCDR.

Flow	Date	Combined Metals lb/day	Flow From Site	Flows At SF 8	Reference
low	Sept 87	650 (300+350)	21.3	72.7	FS Fig. A-3
low	Oct 91	704 [a]	22.5	96.0	McCully, Frick, Gilman, Inc
high	Apr/May 88	2,380	713.0	1,230.0	Page 230 in FS p.2-23
high	May 91	2,531 [a]	653.0	1,700.0	McCully, Frick, Gilman, Inc.

[a] Combined metals cadmium, lead and zinc.

U.S. EPA RESPONSE # 59: Additional flow data is being collected under the 1991 and 1992 Administrative Orders on Consent. These flow data will be considered during remedial design. Regarding Table 4 above, the basis for the estimate of combined metals loading exiting the Site at SF-8 during September 1987 is unclear. Using the same approach as that used to obtain the 704 lb/day estimate for October 1991 (net difference in loading from SF-2 to SF-8), the net contribution from the Site to the SFCDR during September 1987 is 330 lb/day (960 lb/day at SF-8 minus 630 lb/day at SF-2; see FS Figure A-3).

Page 25: "Negligible" should be defined in terms of annual metals loads exiting the site. Also, information is lacking on the number of years required for a given reduction in load from the aggregate of erosion mitigation measures.

U.S. EPA RESPONSE # 60: The term "negligible" has been taken out of its context on p.25 of the Technical Memorandum. Its use on this page is focused on loadings of sediment leaving the Smelter Complex after remedial benefits have been fully realized. In this context, the term "negligible" is not meant to apply to post-remediation metals loadings leaving the Smelter Complex.

Page 90, Table 4-17: Pre-remediation annual load of combined metals in ground water exiting the site is in this table, estimated at 58,035 lb/year (159 lb/day x 365 days), on page 2-18 of the FS net combined metals load entering the SFCDR is 657 lb/day, a net annual load for pre-remediation conditions in ground water of about 239,800 lb/year, and from Figure A-3 of the FS, a total of 977 lb/day of combined metals enters the SFCDR or exits the site as ground water, and could be collected for treatments for a total treatment load of about 356,600 lb/year.

The 58,035 lb/year in Table 4-17 greatly underestimates pre-remediation ground water loads and through comparison it overstates the removal capabilities of Alternatives 2, 3 and 4.

U.S. EPA RESPONSE # 61: The above analysis contains a fundamental error. There is confusion with respect to the spatial locations of the estimates. Those provided on Table 4-17 are for the west boundary of the model domain, which corresponds to SFCDR station SF-7, located above Pine Creek. The net loading to the SFCDR, as presented on Figure A-3 of the FS, includes the entire Site through SF-8 at the west site boundary. The difference between the west site boundary and that of the model domain is repeatedly noted throughout the Technical Memorandum.

The estimated annual loading of 58,035 lb/yr applies only to loadings exiting the model domain in the upper and lower zones at the west model boundary (above Pine Creek). Loadings exiting to surface water are not included because, once contained within the SFCDR, they are accounted for as surface water loadings. Adding the estimated loading for ground water leaving the model (58,035 lb/yr), and the net loading estimated enter the SFCDR (239,800 lb/yr), a total of 297,840 lb/yr is obtained. This estimate is somewhat lower than the 365,600 lb/yr estimate, but several factors account for this. For example, the estimate does not account for any loadings which are transferred to the SFCDR from ground water and then back to ground water in a subsequent losing reach. Also, the estimate of 297,840 lb/day does not account for the influence of Pine Creek or stream/aquifer interactions between the west model boundary (SF-7) and the west site boundary (SF-8).

Also on Table 4-17, Alternative 3 is shown to remove 100.5 lb/day compared to pre-remediation conditions (159 lb/day-58.5 lb/day). This multiplied by 365 days is 36,683 lb/year of combined metals removal by constructed wetlands from ground water. Table 9 of the Constructed Wetlands Treatment Technical Memorandum indicates that 309 lb/day of combined metals within 2.29 cfs of ground water from Reach 5 would be 90-percent treated for a total retention of 101,507 lb/year. In addition the Central Impoundment Area (CIA) seeps are treated as ground water on page 48 and Table 9 of the Constructed Wetlands Technical Memorandum. From Reach 3, partial flow of 2.93 cfs (338 lb/day) would be 90-percent treated, resulting in a total annual retention of 110,033 lb/year. Individually and combined, these projections greatly exceed the 36,683 lb/year projection from Table 4-17.

U.S. EPA RESPONSE # 62: Again, this comment ignores the source-control efforts proposed under Alternative 3 and focuses solely on the constructed wetland treatment systems. The remedial benefit depicted on Table 4-17 (100.5 lb/day loading reduction at the west model boundary) is based on full implementation of Alternative 3. As previously noted, the constructed wetland treatment systems are ancillary measures designed to complement this comprehensive and integrated remedial solution.

The ground water loading reduction estimates at the west model boundary do not include those entering the SFCDR within the Site; these are included as surface water loadings for accounting purposes. Review of Table 4-18 in the Technical Memorandum indicates a projected loading reduction in the SFCDR at SF-8 of 264,400 lb/day for Alternative 3. This large benefit is in part associated with the wetland treatment of ground waters issuing to the SFCDR in Reaches 3 and 5.

We recommend that EPA reevaluate the contribution(s) of the proposed alternatives toward removal of metals load entering the SFCDR from the 21-square-mile Bunker Hill Site prior to alternative selection. A new alternative addressing treatment of all ground water exiting the 21-square-mile site is recommended.

U.S. EPA RESPONSE # 63: Please see U.S. EPA RESPONSE 18.

Table 4-18 and Section 4.3-2, Surface Water: Since treatment alternatives in the FS are currently being restricted to the 21-square-mile site, both pre-remediation loads and load reductions expected of the alternatives presented would be better understood expressed as annual metals loads exiting the site in an average water year. See Table 3 for instantaneous site loads. The relationship between flow and metals load exiting the site is poorly defined from two data points. Additional data are needed.

U.S. EPA RESPONSE # 64: Additional data is being collected under the 1991 and 1992 Administrative Orders on Consent. All available data will be evaluated during remedial design.

A pre-remediation combined metal load of 871,879 is estimated at Pinehurst (FS 8) for the 1987-1988 water year with 236,400 acre-feet of total flow. On page 2-23 of the FS it is stated that the August 1987 through October 1988 sampling was conducted during drought when stream discharges were approximately 25 to 55 percent below average. We recommend that EPA in consultation with the USGS reconstruct an average annual metals load which exits the 21-square-mile site based upon long-term average or median flows of the SFCDR. This new reference metals load would be a valid basis for alternative development and selection for the site.

U.S. EPA RESPONSE # 65: As stated earlier, there is sufficient information in the Administrative Record to support the selection of the preferred remedial alternatives. The additional flow data being collected will be used during remedial design.

From the 1987-1988 RI/FS data, we estimate the total annual metals load exiting the site to be 444,850 lb/year, (650 lb/day x 245 days plus 2380 lb/day x 120 days). However, this load should be adjusted upward because it is based upon a total annual flow of 328,108 acre-feet per year (instantaneous high and low-flow loads times 120 and 245 days, respectively) at station SF 8. Similarly, McCully Frick ad Gilman Inc. 1991 data on cadmium, lead and zinc only equate to a combined load of 476,200 lb/year exiting the site at a flow of 451,172 acre-feet per year. This 1991 load estimate of 476,200 lb/year may best represent present site loading because the flow may have been near average in 1991. A long-term average flow of 465,500 acre-feet can be calculated from the RI, 1967 to 1974 average flow at Kellogg of 331,000 acre-feet expanded by direct proportion for the additional 82 square miles of drainage area at Pinehurst (SF-8).

U.S. EPA RESPONSE # 66: U.S. EPA agrees that the 1991 data may better represent current conditions. Additional data will be considered during remedial design.

The information presented in Table 4-18 should not be used for alternative selection. Table 4-18 indicates that Alternative 3 would result in a net reduction of 264,393 lb/year or 724 lb/day less metal passing through SF 8. Information is needed on the cumulative amount of metals retained on the site specifically because of wetlands operation and related remedial activities to understand the meaning of this change at some undefined point in time.

U.S. EPA RESPONSE # 67: The information in this tech memo is only one part of the feasibility study alternative selection process. Please see U.S. EPA RESPONSE 57 regarding the purpose of this document.

APPENDIX C
COEUR d'ALENE TRIBE OF IDAHO
COMMENTS ON THE PROPOSED PLAN

July 31, 1992

Carol A. Rushin
Deputy for NPL Operations
U.S. EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Proposed Plan for the Bunker Hill Superfund Site

Dear Ms. Rushin:

The Coeur d'Alene Tribe, in its capacity as a sovereign impacted by the release of contaminants in the Coeur d'Alene River Basin and a trustee of the natural resources, has requested that EPA consider and select a remedial alternative which focuses on the restoration of the Basin and its soil, water, air and biota. The alternatives presented in the Proposed Plan all fall substantially short of meeting this objective.

This deficiency is due in part to the failure of EPA to address the entire "facility" as defined by CERCLA Section 101(9). The RI/FS and Proposed Plan do not evaluate alternatives which involve remediation of contaminated areas and control of sources in portions of the facility which lie outside of the 21-square mile boundary of the Bunker Hill site. The selected remedial action should address releases that enter the site from upstream sources which are transported through the site, as well as past releases which have come to be deposited, stored, disposed of, or placed, or otherwise come to be located, in areas outside the boundaries of the Bunker Hill site.

As a result of numerous deficiencies with the RI/FS (refer to our letter dated July 27, 1992) and the failure of the Alternative 3 to adequately meet the threshold criteria of "protectiveness" and compliance with all ARARs, the Tribe does not agree with EPA's selection of this alternative as the "preferred alternative". Given the Tribes concern with the Proposed Plan, our comments must be taken into consideration as a "modifying criteria" with respect to remedy selection. The Coeur d'Alene Tribe's status as a state with respect to this remedial action, and the importance of our people as members of the affected community mandate this degree of consideration. During the reevaluation of the Proposed Plan in light of "state and community acceptance," please consider these and prior comments made by the Coeur d'Alene Tribe in numerous review letters.

The Tribe is also concerned that actions taken by EPA with respect to remediation of the Bunker Hill site may constitute an irreversible and irretrievable commitment of natural resources within the meaning of CERCLA Section 107(f)(1). We have previously requested EPA to include in the Proposed Plan a list of actions or decisions which the agency considers to "constitute an irreversible and irretrievable commitment of resources." The Proposed Plan failed to include this list. We take EPAs failure to provide this list as evidence that there will be no irreversible and irretrievable commitment of natural resources as a result of remedial actions taken at the Bunker Hill site.

Our concerns regarding the Proposed Plan are attached to this letter. Also attached to this letter are our comments on the "Technical Memorandum Evaluating Regulatory Requirements for the Bunker Hill Site." Incorporated by reference is the Tribe's July 27, 1992 letter to EPA on the "Remedial Investigation/Feasibility Study." The Tribe expects that the concerns and comments presented in these letters and attachments will be addressed in the Record of Decision (ROD) for the site.

We appreciate the opportunity to comment on the Proposed Plan.

Sincerely,

Ernest L. Stensgar, Chairman
Coeur d'Alene Tribe of Idaho

COEUR d'ALENE TRIBE OF IDAHO
COMMENTS ON THE PROPOSED PLAN
FOR THE BUNKER HILL SUPERFUND SITE

Our concerns with the comparative analysis of the four alternatives presented in the Proposed Plan are as follows:

1. The alternative remedial actions discussed in the Proposed Plan, including the preferred alternative (Alternative #3), all fail to adequately meet the threshold criteria of overall protection of human health and the environment.

a. The "protectiveness analysis" should (but does not) include consideration of the ability of the various alternatives to attain clean up goals and to ensure that safe threshold levels are not exceeded. The RI/FS for the Bunker Hill Site did not determine safe threshold levels, protective of human health and the environment, for soils, sediments, and air (other than lead). The safe threshold levels for surface water and ground water, which are the FWQC and MCLGs/MCLs, respectively, will be exceeded under all four alternatives. Furthermore, clean up goals, which should have been based on these threshold levels, have not been developed for the site. As a result of these deficiencies, the Proposed Plan's "protectiveness analysis" is incomplete and unreliable.

U.S. EPA RESPONSE # 1: U.S. EPA's protectiveness analysis does in fact evaluate the ability of each alternative to attain cleanup goals established during the initial stages of the FS process (RAOs). Please refer to both the Human Health Risk Assessment (HHRA) and the Ecological Risk Assessment (ERA) documents for a comprehensive analysis of the impacts of site wide containment levels on both human health and ecological receptors.

All remedial actions developed were carefully screened and analyzed relative to the RAOs. Specifically, these analyses included an evaluation of baseline and post-remediation conditions and a comparison with the appropriate criteria. In fact, the technical memoranda were developed to address these issues in greater detail, the expected performance of various remedial measures including a comprehensive analysis of the overall effectiveness of the final alternatives to improve water quality.

With respect to specific numerical values for ecological impacts the literature does not support the selection of an absolute number as a cleanup "goal". As stated in the ERA, the literature does, however, support estimating contaminant ranges in soils which may have a potential impact on sensitive ecological receptors. These numbers are included in the ERA and are summarized in Section 6 of the ROD. Two additional considerations are worthy of note; first, the numbers presented in the ERA are derived from the literature, not from an analysis of actual populations found onsite (the ERA discusses data limitations in more detail); second, due to the widespread habitat destruction onsite, much of the potential impacts to ecological receptors are not occurring at present.

The statement that safe "threshold" levels for contaminants, other than lead, were not determined is incorrect. Both the HHRA and ERA evaluated multiple contaminants. In the case of the HHRA, it was determined that lead was the contaminant most likely to cause impacts to sensitive human populations, and that control of lead sources would also serve to control the other identified contaminants of concern. The HHRA also discusses potential health impacts of these other contaminants. As noted previously the ERA does provide "threshold" levels for potential impacts to terrestrial and aquatic receptors. Soil toxicity reference levels are provided in Table 6-4. For aquatic protection, Federal Water Quality Criteria are considered to be safe "threshold" levels.

Both the RI/FS and ROD discuss the ability of each alternative to attain safe "threshold" levels for contaminants of concern. It is noted that in order for a remedy to provide adequate levels of protectiveness, safe "threshold" levels need not be met at all areas of the Site. U.S. EPA policy gives the agency the flexibility to assure overall protectiveness through a variety of mechanisms, including both engineering and institutional controls.

Admittedly, institutional controls are more effective in controlling human exposure to environmental contaminants than in controlling exposure of ecological receptors. However, many potential exposures of ecological receptors are not currently occurring due to lack of habitat. It is believed that as habitat is established across broad areas of the hillsides and Smelterville flats (much of which has been regraded, or will be capped as part of the selected remedy), actual impact will be limited. Nonetheless, the preferred alternative calls for biomonitoring of sensitive species to verify that projection. The reader is also referred to the considerable success of the Hillsides Revegetation & Stabilization Program in re-introducing vegetative cover to some of the most severely impacted soils within the Site.

b. The "protectiveness analysis" also fails to consider the affects of the alternative actions of fish and wildlife on and downstream of the site.

U.S. EPA RESPONSE # 2: U.S. EPA recognizes that the South Fork Coeur d'Alene River (SFCDR) has been adversely impacted by heavy metal contamination from mining activities at the Site and from over 100 years of historic mining activities upstream from the Site. The remedy selected in this ROD is not intended to specifically remediate contamination of the SFCDR. However, the remedy will eliminate and reduce numerous sources of heavy metal loadings to the river within the 21-square-miles of Site. For example, these sources include runoff from the Smelter Complex, acid mine drainage, portions of ground water from the Smelter Complex, and collected ground water in the artificial wetland in Smelterville Flats, as well as removal of jig tailings from Smelterville Flats and other heavy metal source materials within the Site. Remedial actions will minimize further degradation to the SFCDR. These actions combined with a program to address Basin-wide contamination, will ultimately result in a net improvement of water quality as the SFCDR leaves the Site.

The Coeur d'Alene Basin Restoration Project is being designed to integrate and coordinate the activities within the Coeur d'Alene Basin which are being undertaken by the local landowners, local governments, state agencies, the Coeur d'Alene Tribe, the Federal Natural Resource Trustees, and the U.S. EPA. This includes coordination of regulatory authorities under the Clean Water Act (CWA), CERCLA, and RCRA. Other state, local, and Tribal programs will also be integrated into this Project. The CWA provides a mechanism for developing water quality standards, evaluating discharge permits and establishing nonpoint source controls within the Coeur d'Alene Basin. CERCLA provides a mechanism for investigating and controlling the release of hazardous substances through the exercise of removal authorities.

c. Deficiencies and uncertainties common to all four of the alternative remedial actions include the following (this is not meant to be an exhaustive list):

* The levels of contaminants left onsite (e.g. residual risk) under each proposed alternative scenario remains unknown. The determination of residual risk is paramount to the analysis of whether an alternative is "protective".

U.S. EPA RESPONSE # 3: Residual risk is a function of two primary factors. First, contaminants of concern must be present in site media in concentrations presenting potential risk and second, receptors must be exposed or have access to contaminated media. Risk may be eliminated and/or controlled through several mechanisms. For example, remedial actions can be employed which destroy, or otherwise render contaminants harmless. Additionally, engineering and institutional controls may be employed which effectively limit the exposure of receptors to contaminants of concern. The remedial actions evaluated for the Site rely heavily on engineering and institutional controls to control risk. Therefore an evaluation of residual risk must consider both the physical features of contamination onsite as well as the characteristics of the remedial actions which control exposure pathways.

Currently extensive areas of surface soils present unacceptable potential risk, both to human and ecological receptors. Areas exhibiting excessive soil contamination levels include residential, commercial, and industrial areas; the Smelter Complex and associated facilities; Smelterville flats; and, extensive hillside areas. Remedial actions for these areas rely on consolidation and containment of soil contamination, as well as treatment of Principal Threat Wastes. Residual risk from these areas is expected to be minimal with respect to human receptors as air, water, and direct contact pathways will be reliably controlled. The protective analysis in the FS and the ROD discusses how remedial alternatives control these exposure pathways, thereby addressing the issue of residual risk. Residual risk exists to the extent that engineering and institutional controls are not effective in controlling exposure pathways.

With respect to hillside areas and potential risk to environmental receptors please refer to U.S. EPA Response 1.

* The proposed alternatives fail to adequately address contaminated river sediments;

U.S. EPA RESPONSE # 4: The alternatives discussed in the FS and the Proposed Plan are evaluated with respect to their effectiveness in controlling erosion and subsequent sedimentation from onsite sources of contamination. The Remedial Action selected in the ROD is expected to be very effective in controlling onsite sources of sedimentation due to extensive revegetation, containment, and treatment remedial actions. The broader issue of contamination in the SFCDR, particularly with respect to contributions from upstream sources is outside the scope of this remedial action and will be addressed under the Coeur d'Alene Basin Restoration Project.

* The proposed alternatives fail to address the widely dispersed jig tailings and mixed wastes throughout the site;

U.S. EPA RESPONSE # 5: Alternatives 3 and 4 do address removal of jig tailings in the Smelterville Flats area. Most of the remaining jig tailings within the Site are under areas that have now been developed within the communities. As U.S. EPA stated in the Record of Decision for Residential Soils last year, it is not practical to remove the majority of the tailings within the Site. The Coeur d'Alene River Basin Restoration Project will evaluate appropriate response actions for tailings throughout the entire river basin.

With respect to "mixed waste" it is unclear from the question which "wastes" are referred to. If the question is Bevill vs. non-Bevill waste, U.S. EPA has determined that wastes would be managed as needed to offer an adequate degree of protectiveness. Please see also U.S. EPA Response 12 for additional discussion on management of wastes at the Smelter Complex.

* The proposed alternatives fail to ensure that surface waters on the site and leaving the site are not toxic to aquatic life (see comment 2, below);

U.S. EPA RESPONSE # 6: Alternative 3 remedial actions are expected to result in a 97% decrease in combined metal loadings (CML) from onsite sources, thereby minimizing further degradation of the river. These remedial actions include the erosion control measures already being undertaken on the surrounding hillsides within the Site, other surface water and ground water control measures planned as a part of the closure of the Smelter Complex and the Central Impoundment Area (CIA), and the wetlands treatment systems. Monitoring of surface and ground water quality will continue during remedial design and construction.

With respect to water leaving the Site via the SFCDR, it is expected that site actions alone will be insufficient to achieve Federal Water Quality Criteria; and, U.S. EPA looks forward to the Coeur d'Alene Tribe's participation in the Coeur d'Alene Basin Restoration Project to assist in achieving that goal.

* The proposed alternatives fail to ensure that ground water leaving the site does not exceed non-zero MCLGs and MCLs. Ground water is a potential source of drinking water in areas downstream of the site.

U.S. EPA RESPONSE # 7: Proposed remedial actions are expected to result in significant improvements in ground water quality onsite and improve ground water quality downstream. Institutional controls and additional efforts to control ground water and surface water contaminant sources in the Coeur d'Alene Basin will be required to protect public and private water supplies. Currently, ground water quality at the western site boundary meets most MCLs and non-zero MCLGs. Please refer to RI/FS for more discussion of water quality at specific monitoring locations.

* The proposed alternatives fail to address lower zone ground water.

U.S. EPA RESPONSE # 8: Source control measures are expected to result in improvements in lower, as well as upper zone ground water. Institutional controls will be relied upon to limit access to ground water until monitoring demonstrates that Drinking Water Standards are achieved.

* The potential for bioaccumulation of contaminants through the food chain, which may be exacerbated under the proposed alternatives has not been determined. The revegetation programs (hillsides, Smelterville Flats, CIA, Page Pond, Smelter complex, etc) and the proposed wetland treatment systems may result in an increase in the bioavailability of heavy metals.

U.S. EPA RESPONSE # 9: Biomonitoring is included as a component of the selected remedial action. It will be used to evaluate actual onsite bioaccumulation. The wetland treatment systems technical memoranda provide additional discussion on this subject.

d. Specific concerns with respect to the U.S. EPA's preferred alternative, (Alternative 3) and the degree of protection afforded human health and the environment include the following:

* Pilot studies have not been performed on the wetland treatment system. This system is "innovative" and the ability of it to handle water flows and loadings of the magnitude expected onsite remains unknown. Information provided in the FS indicates that the wetland treatment system falls significantly short of "90 percent or greater reduction in the concentration or mobility of contaminants of concern" recommended by the U.S. EPA in 55 Fed. Reg. 8721. Furthermore, unknowns remain with respect to the frequency at which the wetland substrate will require removal, the expected toxicity of the substrate, and operation and maintenance requirements.

U.S. EPA RESPONSE # 10: The proposed plan is consistent with these policies. The 90 percent reduction is a guideline, not a requirement. It gives U.S. EPA the authority to be flexible as long as health-based goals and other site-specific goals will be met, as reflected in the Proposed Plan.

The Preamble to the NCP states:<u>...U.S. EPA is establishing, as a guideline, that treatment as part of CERCLA remedies should generally achieve reductions of 90 to 99 percent in the concentration or mobility of individual contaminants of concern, although there will be situations where reductions outside the 90 to 99 percent range that achieve health-based or other site-specific remediation goals (corresponding to greater or lesser concentrations reductions) will be appropriate.</u>

In addition, the discussion goes on to state that this guideline may be achieved by the application of multiple technologies, and to repeat the U.S. EPA's emphasis on encouraging innovative technology. Furthermore, it should be noted that the wetland treatment systems are expected to provide 90 percent contaminant load reduction efficiency which is consistent with U.S. EPA criteria for treatment technologies.

Specific to the Tribe's comment on wetlands, it must be recognized that the efficacy of the general hydrologic and biogeochemical approach of using subsurface-flow, gravel-bed wetlands, having a diversity of retention mechanisms available to remediate heavy metals from near-neutral Ph mine drainage, is well established. It is not an experimental idea but has been consistently demonstrated in the laboratory and in the field (see Section 2.9 of the Constructed Wetlands Treatment Systems Technical Memorandum). Accordingly, what is needed to develop constructed wetland treatment systems for Smelterville Flats is a full-scale field module demonstration and tuning program. This is what has been proposed at the Site. Many other wetland treatment scientists are in agreement with this incremental development. Again, to reemphasize this point, the issues are not whether the geochemistry, subsurface-flow hydrology, or wetland biology can be established that will retain metals but what are the actual operating parameters needed to be maintained at this particular site, Smelterville Flats. These operational parameters will be developed as a result of the construction and operation of the first constructed wetland module. Design modifications suggested by the construction and testing of the first constructed wetland module will be used to enhance the development of subsequent constructed wetland modules and to enhance design of the ground water wetland as appropriate.

Contrary to the comment that "Information provided in the FS indicates that the Wetlands Treatment System falls significantly short of '90 percent or greater reduction in the concentration or mobility of contaminants of concern'..." the wetlands technical memoranda indicates that both the collected water and ground water wetlands are expected to meet or exceed 90% of removal efficiency for contaminants of concern under base flow conditions. High flow are not to be treated by these systems; rather, they are addressed by the extensive revegetation and containment components of the selected remedial action.

If the Wetlands Treatment System does not achieve 90% removal efficiencies and water quality based effluent limits pretreatment or alternative treatment of waste streams will be required.

* The wetland treatment system may result in an increase in the bioavailability of metals. The level of protectiveness afforded wildlife, especially migratory birds, is therefore compromised.

U.S. EPA Response # 11: While there are uncertainties regarding the performance of the wetland treatment systems, their performance will be monitored over time. There are no available field data from wetlands associated with mine drainage sites where increased bioavailability has been found or where significant ecological effects for high-trophic-level consumers (especially vertebrate predators such as fox, mink, or raptors) have been observed for the contaminants of primary concern at Bunker Hill (Zn, Cd, Pb, As). Even for free water wetlands where retained heavy metals are relatively available on the sediment surface (unlike the subsurface gravel proposed for wetlands at Smelterville Flats), ecological hazards have not been found to be so significant as to preclude the use of such wetlands as remediation tools (U.S. EPA, 1992). Thus, although retained metals can be observed in sediment and in some of the lower trophic levels, there is no evidence from available studies that higher trophic levels such as migratory birds, fish, and other vertebrate wildlife using wetlands will be impacted by metals retained in subsurface-flow, gravel bed treatment systems at Smelterville Flats.

Please see the Wetland Tech Memos for additional discussion of this issue.

* Untreated hazardous waste and waste exhibiting characteristics of hazardous waste will be placed in unlined "landfills" at the Smelter Complex and CIA. A large portion of the waste to be "consolidated" in these two areas remains untested with respect to the TCLP; however, information in the RI indicates that many of these wastes and materials contain high levels of contaminants. The potential for migration of these contaminants from an unlined "landfill" is of great concern.

U.S. EPA RESPONSE # 12: The Preferred Alternative does not include the construction of landfills, but closure of <u>existing facilities</u>, unlined or otherwise. The vast majority of the wastes to be left onsite are exempt from RCRA C requirements under the Bevill Amendment as mining beneficiation or extraction wastes. These wastes are not subject to the requirement of TCLP testing. The U.S. EPA is not required to test all of the wastes left in place at the Site, and there is no test for the Bevill exclusion, which is determined pursuant to the U.S. EPA's regulatory criteria. 40 CFR 256.4(b)(7). The TCLP test is therefore not determinative regardless of whether the Bevill exempt materials fail such testing. Nonetheless, the Preferred Alternative does incorporate significant protective measures such as caps and surface water runoff controls to minimize migration. Principal Threat Wastes are being evaluated under treatability studies and will be treated prior to consolidation onsite. The preferred alternative *also encourages removal and recycling or reprocessing of many of these materials containing high levels of metals.*

Federal and State hazardous waste laws and regulations will be attained for any hazardous waste onsite. Section 3001(b)(3)(A)(ii) of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6921(b)(3)(A)(ii), excludes "solid waste from the extraction, beneficiation and processing of ores and minerals" from regulation as hazardous wastes under Subtitle C of RCRA. This exemption is based on U.S. EPA's 1978 "special waste" criteria for high volume and low hazard wastes. Following U.S. EPA's 1985 Report to Congress, U.S. EPA issued a regulatory determination in 1986 excluding all mining extraction and beneficiation wastes from regulation under Subtitle C of RCRA. 51 Fed. Reg. 24,496 (July 3, 1986). Accordingly, the mine and mill tailings prevalent throughout the Site are exempt from regulation under Subtitle C of RCRA. See Solite Corp. v. U.S. EPA, 952 F.2d 473, 477 n. 1 (D.C. Cir. 1991).

In 1989, U.S. EPA promulgated its final "high volume" and "low toxicity" criteria for determining which mineral processing wastes remain exempt under the Bevill exclusion, and proposed to finalize the scope of the Bevill exclusion for 20 mineral processing wastes under study. 54 Fed. Reg. 36,592 (Sept. 1, 1989), 54 Fed. Reg. 39298 (Sept. 25, 1989). U.S. EPA finalized the list of mineral processing wastes subject to the Bevill exclusion in 1990. 55 Fed. Reg. 2322 (Jan. 23, 1990). Only the 20 mineral processing wastes specifically listed in 40 CFR 261.4(b)(7) remain exempt from regulation under Subtitle C of RCRA.

In addition to mine and mill tailings at the Site which are exempt from Subtitle C as beneficiation and extraction wastes, lead slag and phosphogypsum from phosphoric acid production produced at the Site are exempt as mineral processing wastes (see 40 CFR 261.4(b)(7)). Subtitle C regulations are thus not applicable for substantially all mine tailings and other wastes from the extraction, beneficiation and mineral processing activities at the Site.

Although not applicable at the Site, U.S. EPA has determined that the Federal and State technical requirements for capping mine waste piles and construction of solid waste impoundments are relevant and appropriate at the Site, and will be attained by the selected remedy. The Preferred Alternative does not include the construction of landfills, unlined or otherwise. In addition to caps and surface runoff controls to minimize migration, the treatment of Principal Threat Wastes at the Site are being evaluated under treatability studies and will be treated prior to consolidation within the Lead Smelter at the Site. Processing wastes that are not Principal Threat Wastes will be consolidated within the Smelter Complex (part of the Area of Contamination) and will be managed consistent with relevant and appropriate closure requirements (40 CFR Part 264, Subpart G).

e. The lack of "protectiveness" should have resulted in the screening out of the Alternatives 2, 3, and 4 during the detailed analysis. U.S. EPA should have required the evaluation of, and should have selected an alternative which addresses contaminated river sediments, dispersed waste, contaminated surface water flowing through and off the site, ensures the control of contaminated ground water, and includes safeguards in order to prevent the exacerbation of problems associated with bioaccumulation.

U.S. EPA RESPONSE # 13: The ROD provides the basis for the selection of remedial action. For additional discussion please see U.S. EPA RESPONSES 2, 3, and 4 above.

2. All four of the alternative remedial actions discussed in the Proposed Plan, including the preferred alternative (Alternative 3), fail to adequately meet the threshold criteria of compliance with ARARs.

a. Information provided in the RI/FS and related technical memoranda indicate that surface water and ground water ARARs for many of the contaminants of concern will not be attained (during a reasonable time period) under any of the four proposed alternatives. Thus, these alternatives should have been screened out during the detailed analysis (unless a waiver is justified). A protective remedy should be evaluated and selected as preferred. The Tribe believes the failure of the U.S. EPA to require an analysis of alternatives which addresses all known onsite sources of contamination (i.e. dispersed jig tailings and mixed wastes), addresses surface water contamination entering the site from upstream sources, and incorporates both recycling, reprocessing, or treatment to reduce toxicity, mobility, and volume, and disposal in an engineered repository which meets the substantive requirements of RCRA for landfills, should preclude the agency from including a "contingency waiver" in the ROD.

U.S. EPA RESPONSE # 14: In general, the ground water and surface water is impacted from numerous point and non-point sources of heavy metal contamination in the entire Coeur d'Alene Basin, including the Site. In addition to the rich mineralization of the Basin, which contributes to a naturally elevated level of contaminants of concern in the ground water, over 100 years of historic mining and subsequent acceleration of the weathering of mineralized rock has exacerbated such contamination.

U.S. EPA recognizes that attainment of certain chemical specific standards or criteria may take several years <u>or</u> may, from an engineering standpoint, be technically impracticable. However, this situation is not unique to Bunker Hill. U.S. EPA policy and guidance on remedial approaches to contaminated ground water and surface water recognizes that due to numerous factors, such as adsorption/absorption on contaminated soils and sediments that are separate from discrete source materials, attainment of specific numerical values may not be possible. The agency's policy is to pursue cleanup of such materials to the maximum extent possible and practicable. This can best be determined by undertaking remedial actions and monitoring the ability of those actions to meet performance standards.

The alternative to this for the areas impacted by discrete source areas is complete removal. In the case of the Site, there would continue to be impacts from contaminated ground water until that ground water was completely remediated through interception and treatment or through natural attenuation. In addition, upstream sources, which are being addressed through the Coeur d'Alene Basin Restoration Project, would continue to impact local ground water and surface water. Finally, complete removal of all discrete source materials within the Site was rejected for residential areas in the Residential Soils ROD (Aug 1991) and was screened out in the Non-Populated Areas FS as being technically impracticable.

b. The Proposed Plan states (Page 8, paragraph 3): "Offsite seeps and loadings and the widespread existence of jig tailings onsite are expected to inhibit immediate compliance with ...ARARs in some areas of the site....Ultimate attainment [of ARARs] will depend on the implementation and effectiveness of offsite programs." We can find no legal authority for basing the attainment of ARARs on offsite actions which are not addressed under the CERCLA program. Furthermore, the FS and the Proposed Plan fail to clarify what is meant by "...these standards will be met in many areas...<u>over time</u>." (Page 9, paragraph 1) This open-ended statement provides little assurance to the affected community that the contamination problem will be adequately addressed within a reasonable time frame.

U.S. EPA RESPONSE # 15: See U.S. EPA RESPONSES 2, 3, 4, and 14 above regarding offsite activities under the Coeur d'Alene River Basin Restoration Project. See ROD Section 10.2 for additional discussions on conditions for granting an ARAR waiver.

c. The Tribe does not agree with the U.S. EPA's approach to ARAR waivers for the Bunker Hill Site. The Proposed Plan states (Page 10, paragraph 6): "ARARs waivers for onsite actions, with respect to ground water and surface water, will be considered only after review of the capability of the performance standards for selected remedial actions to be effective over time." The U.S. EPA's approach at the Bunker Hill Site does not ensure that the selected remedial action will be able to meet ARARs. This approach will allow the full implementation of an ineffective remedial action. Then, once the remedial action is discovered to be ineffective (following the five year review), the U.S. EPA could grant a waiver to justify the deficiencies in the remedial action.

Compliance with ARARs (unless grounds for invoking a waiver is provided and supported) is a threshold criteria that must be satisfied by an alternative <u>before</u> it can be selected.
The NCP states that ..."compliance with ARARs (unless a specific ARAR is waived) [is a] threshold requirement that each alternative must meet in order to be eligible for selection" (40 CFR 300.430 (f)(1)(A)). Implicit in this statement is a mandate that each alternatives' ability to meet ARARs be determined during the remedy selection process. Such a requirement ensures that remedial actions which are inadequate, or which are doubtful with respect to their ability to meet ARARs, will not be selected and implemented.

If the attainment of ARARs through onsite actions is found to be technically impracticable from an engineering perspective, an ARAR may be granted. However, a fully protective alternative must be (but was not) designed and adequately evaluated before such a waiver is granted.

U.S. EPA RESPONSE # 16: Please see Section 10.2 of the ROD for discussions on conditions for granting ARAR waivers.

d. Finally, with respect to ARAR compliance, please refer to the Tribes comments (attached) on the "Technical Memorandum, Evaluating Regulatory Requirements for the Bunker Hill Site" and comments on the Final RI/FS for the Bunker Hill Superfund Site (incorporated by reference).

NOTE: Please see U.S. EPA responses on the Tribe's comments on this Technical Memorandum following this letter.

3. The determination that Alternatives 2, 3, and 4 provide long-term effectiveness is based on an inadequate analysis of the relevant factors.

a. The analysis under this criterion should focus the residual risk remaining onsite after the completion of the remedial action. This consideration should assess how much of that risk is associated with treatment residuals and how much is associated with untreated waste (55 Fed. Reg. 8720). The potential for this risk may be measured by numerical standards such as cancer risk levels or the volume or concentration of contaminants in waste, media or treatment residuals remaining onsite (55 Fed. Reg. 8720). Neither the RI/FS nor the Proposed Plan provide useful information regarding the degree of contamination and associated risk that will remain onsite following remediation under the alternative scenarios. It is therefore not possible to determine the long-term effectiveness of the various alternatives.

U.S. EPA RESPONSE # 17: Detailed estimates of long-term concentration and loading reductions potentially occurring under the FS alternatives are provided in the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4.

For further discussion on residual risk please see U.S. EPA RESPONSE 3 above.

b. The lack of information regarding removal efficiency and the long-term maintenance requirements of the innovative wetland treatment systems and associated risks also weakens the analysis of long-term effectiveness.

U.S. EPA RESPONSE # 18: Wetlands Technical Memoranda included in the Administrative Record provide extensive discussion of wetland performance, design considerations, and operational issues. Additionally, performance standards will provide additional assurance that systems will perform adequately.

c. The analysis of long-term effectiveness should have included consideration of the adequacy of any controls (e.g., engineering or institutional controls) used to manage the hazardous substances remaining at the site (55 Fed. Reg. 8720). The Proposed Plan states that Alternatives 3 and 4 will meet all soil and air RAOs, most of the surface water and ground water RAOs, and all of the site wide RAOs. However, the document does not provide a substantive discussion on the adequacy of the proposed remedial actions. For example, the Proposed Plan fails to specify the performance standards for actions on the hillsides (% cover, species diversity, % flood retention, tributary water quality); Smelterville Flats (treatment effluent water quality, total metal load allowed); CIA (permeability of cap, actions levels for material accumulations, percentage of seep intercepted and treated); Smelter Complex (action levels for remediation, treatment and disposal, TCLP criteria); Constructed Wetlands (effluent water quality; efficiency of ground and surface water capture); Railroad Rights-of-Way (action levels for removal/replacement); and soil action levels for the non-populated areas of the site. The Proposed Plan also fails to identify clean-up levels for various media.

With respect to adequacy of actions proposed under Alternative 3, the Proposed Plan fails to inform the reader that information in the FS and related technical memoranda indicates that the performance of the innovative wetland treatment system (Alternative 3) is expected to fall substantially short of the "90 percent or greater reduction in the concentration or mobility of contaminants of concern" recommended by the U.S. EPA in 55 Fed. Reg. 8721.

U.S. EPA RESPONSE # 19: The Feasibility Study, Proposed Plan and ROD provide extensive discussion of the adequacy of alternative Remedial Actions. The ROD also provides performance standards for remedial action as well as a discussion of soil action levels.

As noted earlier,the last paragraph of the Tribe's comment incorrectly evaluates treatment system removal efficiency. See U.S. EPA RESPONSE 10 for further discussion.

d. Information on the effectiveness of the interim remedial and removal actions implemented (or being implemented) onsite is an essential factor in the determination of "baseline conditions." An accurate assessment of baseline conditions is, in turn, essential to the determination of adequacy of the remedial alternatives. Unfortunately, the Proposed Plan fails to discuss the effectiveness and success of the interim actions. The Tribe is especially concerned with the success (or lack of success) of the Superfund revegetation efforts.

U.S. EPA RESPONSE # 20: As stated previously the Proposed Plan is intended to be a non-technical summary of the results of the RI/FS. U.S. EPA will continue to monitor the effectiveness of the interim actions to ensure that performance standards are being met. For example, the Hillsides Administrative Order on Consent, which covers the revegetation efforts, contains provisions for monitoring the effectiveness of selected response actions in meeting performance objectives outlined in the work plan.

e. The analysis of long-term effectiveness should include consideration of the reliability of any controls used to manage the hazardous substances remaining at the site (55 Fed. Reg. 8720). The determination of reliability of the various alternatives proposed in the Plan is undermined by the failure of the U.S. EPA to require the following: 1.) pilot studies on innovative technologies, such as the wetland treatment system; 2.) treatability studies on many of the types of principal threat wastes to be stabilized and capped onsite; 3.) TCLP testing of the large amounts of potentially hazardous substances not labeled principal threat wastes. Furthermore, the reliability of the unlined "landfills" proposed in Alternative 3 (Smelter cap and CIA cap) with respect to preventing migration of contaminants to the ground water remains unknown.

U.S. EPA RESPONSE # 21: With regard to the wetlands treatment system, extensive literature review and technical expert discussion provided in the Wetlands Tech Memos support the selection of this action. During remedial design, and initial remedial construction, additional information will be collected to refine system operational parameters.

Treatability Studies for Copper Dross Flue Dust Pile are currently ongoing, and will be used in determining appropriate design mixes for Principal Threat wastes.

The remedial actions selected for the Smelter Complex constitute closures of existing facilities within an area of contamination and not the creation of a new landfill. However, U.S. EPA is requiring the closure to include components protective of human health and the environment. These components include leachate collections systems, low-permeability cap, and ground water monitoring to evaluate performance. These actions are intended to be protective whether or not the materials fail TCLP tests.

4. The U.S. EPA's determination that "Alternative 3 goes further toward satisfying the statutory preference for reduction of toxicity, mobility and volume [through treatment] of contaminants than other alternatives" (Page 11, paragraph 2) is not supported by information provided in the RI/FS, related technical memoranda, and Proposed Plan.

a. The use of treatment technologies, even if innovative, are not preferred unless they permanently and significantly reduce the toxicity, mobility or volume of the hazardous substances (see 55 Fed. Reg. 8721). Adequate information has not been provided regarding the wetland treatment systems and cement stabilization process to determine the magnitude, significance and irreversibility of the reductions achieved under Alternative 3.

U.S. EPA RESPONSE # 22: With respect to treatment of Principal Threat waste with cement based solidification technology, this method of treatment of metals contaminated soils and material accumulations is well established and not considered "innovative". Wetland issues are addressed in U.S. EPA RESPONSE 21, the RI/FS and Wetland Technical Memoranda.

b. For example, although Alternative 3 provides for the treatment of Principal Threat Materials from the Smelter Complex, the effectiveness of the treatment remains largely unknown due to the failure of the U.S. EPA to require treatability studies on many of the wastes. The issue is further confused by the failure of the RI/FS to include criteria for determining whether a waste is a "principal threat". It is therefore not clear whether or not Alternative 3 (containment of treated waste in an unlined landfill) would provide superior reduction in mobility when compared to Alternative 4 (containment of untreated waste in an engineered, lined repository).

U.S. EPA RESPONSE # 23: Principal Threat levels are contained in the Principal Threat Technical Memorandum, which is included in the Administrative Record, as well as the Record of Decision. Treatability studies for principal threat wastes have begun and will continue during remedial design. Appropriate tests will be utilized to design a mixture that provides adequate protectiveness (as measured by the RCRA Land Disposal Restriction treatment requirements utilizing a rain water leach test). Treatment of the Principal Threat wastes combined with consolidation in the Smelter closures provides a comparable or greater level of protectiveness than Alternative 4.

c. It should also be noted that cement stabilization procedure (as proposed under Alternative 3) will result in doubling the volume of waste to be disposed of.

U.S. EPA RESPONSE # 24: Preliminary treatability testing results indicate an increase in density with the addition of cement and lime, resulting in small volume increases, although it is not expected to double in volume.

The Smelter complex closure can easily accommodate the volume increase resulting from the treatment process.

d. The RI/FS, Technical Memoranda, and Proposed Plan do not quantify nor adequately discuss the degree to which the innovative wetland treatment system (Alternative 3) and the conventional water treatment system (Alternative 4) reduce the toxicity, mobility and/or volume of surface water and ground water contaminants. In addition, the propensity of the residuals of the wetland treatment system to bioaccumulate should have been factored into the comparative analysis under this criterion.

U.S. EPA RESPONSE # 25: The Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2,3, and 4 and the Constructed Wetlands Technical Memoranda provide estimates of the performance of remedial actions in treating Site ground water and surface water onsite. Both mass loading estimates and resulting media concentration projections are provided. The Constructed Wetlands Technical Memorandum and U.S. EPA's Wetlands Technical Memorandum discuss the potential for bioaccumulation in the constructed wetland systems. For further discussion please see also U.S. EPA RESPONSE 11 above.

e. As mentioned in our earlier comment letters, the RI/FS should have (but did not) evaluate an alternative which incorporates the strong points of both Alternatives 3 and 4, e.g. an alternative which includes treatment of principal threat materials (and other hazardous materials) and containment onsite in an engineered, lined repository. This alternative may have provided superior "reduction of toxicity, mobility or volume" of hazardous substances.

U.S. EPA RESPONSE # 26: Remedial alternatives are selected to represent a range of treatment and containment options, as appropriate (U.S. EPA RI/FS guidance, page 4-5 OSWER Directive 9355.3-01, October 1988). Alternatives presented in the FS were developed as the result of a multi-step process outlined in the above-referenced RI/FS Guidance. As stated in the Proposed Plan and ROD, U.S. EPA has determined Alternative 3 to be effective in reducing the toxicity, mobility, and volume of hazardous substances at the Site. U.S. EPA has determined that the closure of existing facilities (i.e., Lead Smelter and Zinc Plant) in place, following cement-based solidification of Principal Threat wastes, will offer a comparable level of protectiveness compared to consolidation of treated material within a lined repository given the specific circumstances at the Site.

5. The comparative analysis with respect to short-term effectiveness is incomplete and inadequate, and creates an unwarranted bias in favor of Alternative 3.

a. The Proposed Plan states that Alternative 4 poses substantially greater risks [than Alternative 3] due to more extensive excavation efforts (Page 11, paragraph 3). However, there is no difference in the nature of the excavation efforts proposed in Alternatives 3 and 4; the difference is simply a matter of scale. Therefore, with proper management and planning, there should only be a slight increase in short-term risk under Alternative 4 when compared to similar risk posed under Alternative 3. The RI/FS and Proposed Plan fail to adequately discuss the effectiveness and reliability of mitigative measures to be taken during implementation.

U.S. EPA RESPONSE # 27: Statements made in the Proposed Plan and ROD reflect U.S. EPA's judgement with respect to the relative risk posed by the excavation and transportation of materials required by each of the Alternatives evaluated for the Site. In the case of Alternative 4, significantly greater volumes of materials are excavated and transported compared to other alternatives. This is especially true for the additional excavation of *accessible jig tailings, but is a consideration in remedial actions at the Smelter Complex as well. Increased excavation and transportation, no matter how effectively managed, pose some risks to workers and the community. The purpose of the evaluation of short-term risks is to insure that the risks posed by remedial alternatives are considered along with the residual risk posed by Site contaminants after the completion of remedial actions.*

With respect to mitigation measures to be taken during remedial action implementation, the ROD includes a general discussion of the need for protection of the community and environment during remedial actions. However, the specifics of mitigation measures will be determined during the Remedial Design phase of the project.

b. The analysis of this criterion should have taken into consideration the "Time until protection is achieved" (40 CFR 300.430 (e)(9(iii)(E)). Alternative 4 could conceivably be superior to Alternative 3 with respect to short-term effectiveness since a larger portion of the source material is removed and contained (or disposed of offsite). This should decrease the amount of time required to achieve protection onsite.

U.S. EPA RESPONSE # 28: Alternative 4 would be expected to take longer to implement than Alternative 3 due to the significantly greater volume of material to be consolidated onsite. With respect to the relative ability of Alternatives 3 and 4 to be adequately protective of human health and the environment, and achieve ARARs, U.S. EPA has determined that the two alternatives offer a comparable degree of effectiveness and would not expect Alternative 4 to offer appreciably greater short-term benefits.

6. The comparative analysis with respect to implementability fails to fully evaluate the uncertainties associated with the wetland treatment system (Alternative 3).

a. In the Proposed Plan's discussion on Implementability of the alternatives (Page 11, paragraph 4) there is no mention of the management of wetlands substrate which may need to be excavated and disposed of as hazardous waste. The difficulties and unknowns associated with the construction and operation of wetland treatment systems the size of those proposed under Alternative 3 should have been discussed in more detail and considered more thoroughly in the comparative analysis for this criterion.

U.S. EPA RESPONSE # 29: Constructed Wetland Technical Memoranda discuss the operational and performance characteristics in considerable detail. U.S. EPA has determined, based on available information, that the wetlands systems will meet performance standards specified in the ROD. If monitoring of system performance demonstrates that the constructed wetlands are not meeting performance standards or water quality based effluent limits, additional treatment mechanisms will be integrated into the remedial action.

With respect to the disposition of wetland substrate, monitoring data will be used to evaluate the characteristics of this material and provide a basis for determining the appropriate management of this material. RCRA Subpart X may be determined to be relevant and appropriate based on monitoring data.

b. The fact that Alternative 3 will also involve a loss of developable land is not included.

***U.S. EPA RESPONSE # 30:** Loss of developable land due to Alternative 3 remedial actions is expected to be limited. Areas to be committed to constructed wetlands are currently in the SFCDR floodplain and have limited development potential. Other areas of the Site with limited development potential in the future include the CIA and Smelter Complex closures. However, these areas are currently not available to development due to the presence of contaminants posing a direct contact risk.*

7. The statement that "Although Alternative 3 is significantly lower in costs than Alternative 4, it provides comparable environmental and human health protection...." is not supported by the information provided in the RI/FS, Technical Memoranda, and Proposed Plan.

a. The degree of protection provided by Alternatives 2, 3, and 4 has not been determined (please see discussion above regarding "protection of human health and the environment" and "long-term protectiveness"). The residual risks associated with each alternative remedial action and the ability of each of the alternatives to meet ARARs has not been adequately evaluated. Therefore, conclusive statements based on the comparative analysis of "protectiveness" provided by Alternatives 3 and 4 can not be made.

***U.S. EPA RESPONSE # 31:** Please see U.S. EPA RESPONSES 3 and 14 for discussion of these concerns. See ROD Section 10.2 for further ARARs discussions.*

b. The Proposed Plan states that Alternative 3 offers additional benefits due to innovative ground water and surface water treatment methods and the reprocessing/recycling of high concentration waste accumulations (Page 12, paragraph 1). However, as discussed above under comment 4 ("reduction of toxicity, mobility, and volume") the effectiveness of the wetland treatment systems and the cement stabilization process have not been adequately tested through pilot tests and treatability studies. It remains unknown whether the innovative technology proposed under Alternative 3 provides superior protection and "additional benefits" when compared to the actions proposed under Alternative 4.

***U.S. EPA RESPONSE # 32:** Performance standards included in the ROD are intended to ensure that cleanup objectives are met. Treatability studies for cement-based stabilization of Principal Threat wastes are currently ongoing. The recycling, reprocessing, and treatment of these materials offer additional benefits not provided by Alternative 4.*

c. The RI/FS and Proposed Plan fail to quantify the increased benefits which will be realized with each alternative. Therefore, costs and benefits can not be compared, and the statement that "The increased benefit for Alternative 4 is small relative to the increase in cost" (Page 10, paragraph 3) remains unsupported.

U.S. EPA RESPONSE # 33: The U.S. EPA directed the authors of the FS to prepare the Post-Remediation Water Quality Projections Technical Memorandum in direct response to the concerns previously raised by the Coeur d'Alene Tribe. While this analysis has limitations, it is effective in comparing the relative benefits of Alternatives 2, 3, and 4. The FS contains extensive discussion on other benefits of each Alternative.

8. In general, the Proposed Plan does not provide support for the conclusions in the comparative analysis of the various proposed alternatives.

While the Tribe appreciates the need to explain the analysis in simplified, non-technical terms to the public, facts essential to the comparison of alternatives should have been included, such as the following: Clean up goals and the success of each alternative in obtaining these goals; percent contaminant reduction in surface water, ground water, air, and soils expected under each scenario alternative; the expected efficiency (expressed in percent) of the wetland treatment systems and the conventional water treatment system; the volume of jig tailings left in place under Alternatives 2, 3, and 4; and the residual risk associated with each of the alternatives.

U.S. EPA RESPONSE # 34: Among other references, Section 8 of the ROD, Feasibility Study, and supporting technical memoranda contain additional details responsive to these concerns.

9. Given the apparent uncertainties regarding the achievement of ARARs and remedial goals, contingency measures and the criteria for implementation of the measures should be specified in the Record of Decision (ROD).

U.S. EPA RESPONSE # 35: The ROD discusses Performance Standards for several of the selected remedial actions. Certain contingency measures are discussed in the ROD. These contingency measures and others, if necessary to meet performance standards, will be further developed in the Remedial Design plans and Operation and Maintenance plans for selected remedial actions. See Section 10.2 in ROD for further ARARs discussions.

10. The comparative analysis of remedial action alternatives does not support the selection of Alternative 3 as the preferred alternative. In fact, the results of the analysis mandates that a fifth, more protective alternative which will comply with all ARARS, be evaluated for the remedial action.

The Tribe believes that the U.S. EPA should select a remedy which, through onsite action, ensures that all ARARs are met, addresses the water quality of the South Fork of the Coeur d'Alene River (including loadings entering the site from sources upstream), addresses problems associated with bioavailability of metals, and which restores the natural resources in the Basin. This fifth Alternative should incorporate recycling, reprocessing, or treatment to reduce the toxicity, mobility and volume, and disposal of waste in an engineered repository which meets the substantive requirements of RCRA for Landfills (including the double liner requirement).

U.S. EPA RESPONSE # 36: The issues raised in this question have been discussed in many of the previous responses. U.S. EPA has determined that Alternative 3 provides overall protection of human health and the environment and will satisfy the requirements of Section 121 of CERCLA. U.S. EPA appreciates the Tribe's concerns regarding the Coeur d'Alene River Basin and looks forward to the Tribe's active participation in the Coeur d'Alene Basin Restoration Project.

COMMENTS ON "TECHNICAL MEMORANDUM,
EVALUATING REGULATORY REQUIREMENTS FOR THE
BUNKER HILL SITE," JUNE 1992

1. The failure of the U.S. EPA to require the PRPs to identify the specific wastes onsite which fall under the Bevill exclusion (and thus are not subject to RCRA Subtitle C regulation) undermines the determination of which RCRA requirements are "relevant and appropriate" to the remedial action. The determination of which wastes are legally excluded from RCRA Subtitle C requirements, and the testing of the remaining wastes for toxicity and mobility, should have been the first step in analyzing the relevance and appropriateness of RCRA Subtitle C requirements.

Unfortunately, the determination of what wastes onsite are "Bevill excluded" was never made (see page 3, paragraph 1, Technical Memorandum). The proportion of wastes which are "Bevill excluded" vs non-excluded (including mixed wastes exhibiting hazardous characteristics) should have strongly influenced the determination of whether specific RCRA requirements are relevant and appropriate[1].

Footnote #1: The wastes identified under the Bevill amendment are excluded because they are considered to be "high volume and low hazard". Wastes with such characteristics are expected to pose less of a risk to human health and the environment than non-excluded mining wastes. Therefore, the identification of a waste as Bevill-excluded lends credence to the determination that RCRA Subtitle C requirements are not relevant and appropriate to the remediation of these wastes. Conversely, mining wastes which fall outside the exclusion are presumed to pose a higher risk to human health and the environment, and unless these wastes are "listed wastes" (and thus, subject to RCRA regulation), they must be tested to determine their toxicity and mobility (using TCLP tests). The remediation of a site containing listed wastes and characteristic wastes should follow more stringent guidelines (such as RCRA Subtitle C minimum technological requirements) than one containing only excluded wastes.

The U.S. EPA has not provided, and we have not found, any justification for not identifying the waste as hazardous, non-hazardous, or exempt. Although the memorandum states (page 3, paragraph 1) that "For the purposes of determining relevant and appropriateness of RCRA requirements, these solid wastes will be considered as non-Bevill wastes," the U.S. EPA has not emphasized the importance of meeting minimum technological requirements which are designed to protect against risks posed by highly toxic materials.

U.S. EPA RESPONSE # TM-1: With respect to RCRA ARARs, U.S. EPA's June 1992 Technical Memorandum Evaluating Regulatory Requirements for the Bunker Hill Site provides an extensive discussion of this issue. The reader is referred to that memo for further information.

In general, RCRA has limited applicability at the Site. First, U.S. EPA has determined that the contaminated areas of the Site constitute a single area of contamination (AOC), based upon analytical data that demonstrate the continuous contamination onsite from air deposition and other onsite activities. By definition, relocating, consolidating, and handling of hazardous wastes within this AOC is not "placement" and thus will not trigger potentially applicable Land Disposal Restrictions. Second, extensive areas of the Site are contaminated by Bevill-exempt wastes, which are exempt from RCRA subpart C requirements. Third, there are currently no applicable requirements for mineral processing wastes with respect to the selected remedial actions.

Notwithstanding, because this Site poses problems similar to those addressed during RCRA "closure", U.S. EPA has determined that certain aspects of RCRA are relevant and appropriate. For example, relevant subpart G closure requirements will be applied to the Lead Smelter and Zinc Plant closures, including a low permeability cap and leachate collection.

It is noted that RCRA Minimum Technology Requirements (MTRs) only apply to new units, replacement units, and lateral expansions of existing landfills (40 CFR 254.301 (c)). Therefore, an existing landfill or AOC would not be subject to MTR, even if disposal of hazardous waste occurred as part of a CERCLA Action (Reference RCRA ARARs, Focus on Closure Requirements, Oct. 1989, OSWER Directive 9234.2-04FS). Therefore, MTRs such as a double liner are not applicable to closure of the Smelter Complex facilities. U.S. EPA has further determined that these requirements are not relevant and appropriate for this action. Instead, as noted above, U.S. EPA has determined that certain RCRA closure requirements are relevant and appropriate for this action.

U.S. EPA has considered the characteristics of the Site compared to a "typical" mining site when making determinations regarding the relevance of RCRA requirements and the degree of protectiveness afforded by various remedial actions. For example, although high concentration extraction and benefication material accumulations (such as lead and zinc concentrates) are Bevill exempt, U.S. EPA is requiring treatment of these materials prior to consolidation in the Lead Smelter Closure when concentrations exceed Principal Threat Thresholds.

Decisions regarding the relevance of RCRA to closure of Page Pond, the CIA, and the Smelter Complex, and remedial actions selected for the MOA and Smelterville Flats were made primarily based upon insuring protectiveness, not a Bevill/non-Bevill determination. Please see the ROD and Tech Memo for additional discussion.

2. The Technical Memorandum states (page 2, paragraph 3): "Additional examples of solid wastes that are Bevill exempt are...tailings (beneficiation) in the CIA and the Page Pond areas." The CIA is a mixture of tailings and other hazardous wastes. These wastes are not necessarily Bevill exempt, and can not be assumed to be, unless testing indicates otherwise.

The waste must be tested to determine if it exhibits "a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred or it continues to exhibit any of the characteristics exhibited by the non-excluded wastes prior to mixture" (see 40 CFR 261.3 (2)(i) and 57 Fed. Reg. 7628).

U.S. EPA RESPONSE # TM-2: Smelter cleanup materials consolidated in the CIA in 1982, will be removed and included in the Lead Smelter Closure. Any of these materials exceeding Principal Threat Threshold concentrations will be treated with cement based stabilization, recycled, or reprocessed. Please see also U.S. EPA Response TM-1.

3. The Technical Memorandum states (page 3, Paragraph 1) that "...many solid wastes consist of consolidated mixtures of Bevill and non-Bevill wastes...." Later in the same paragraph the text states "Because this remaining quantity of mixed wastes in the Smelter Complex is relatively small, identification and separation of these mixtures may not be practicable...." It is unclear what is meant by "the remaining quantity..." This ambiguous statement is then used as support and justification for the lack of testing performed on the mixed wastes.

Unfortunately, the RI/FS never defines what is considered "mixed wastes" onsite. The Tribe can, therefore, only guess that mixed wastes refers to all wastes which include both Bevill and non-Bevill wastes, and thus the term encompasses a large portion of the contaminated materials and soils onsite. As explained in Comment #2, above, these wastes must be tested to determine the relevance of RCRA requirements.

U.S. EPA RESPONSE # TM-3: Consolidation of material within the Lead and Zinc Plant closures does not constitute "placement" because these areas are within the Area of Contamination and thus will not trigger Land Disposal Restrictions. Testing of wastes prior to closure will provide no additional benefit because closure of these areas will be undertaken consistent with relevant and appropriate RCRA Subpart G closure requirements, 40 CFR Part 264, regardless of the Bevill status.

4. The Technical Memorandum states (Page 3, Paragraph 1) "that the determination of relevant and appropriateness of RCRA/HWMA requirements will be based on hazardous properties of the wastes, its composition and matrix, the characteristics of the site, ...and the purpose of the requirement itself...."

a. The majority of the contaminated materials onsite (including soil and debris) have not been tested to determine the hazardous properties of such wastes. Furthermore, earlier in the same paragraph, the text states that identification and separation of mixtures at the Smelter Complex location was not (and will not) be attempted.

U.S. EPA RESPONSE # TM-4a: Please see Section 3.0 of the Technical Memorandum on Evaluating Regulatory Requirements regarding Areas of Contamination.

Materials that are clearly Bevill exempt, including jig tailings, tailings in impoundments, slag, gypsum, and mine waste rock are not subject to testing. Material accumulations being consolidated within the Smelter closures will be presumed to exhibit RCRA characteristics based upon information collected in the RI making additional testing unnecessary. Closure of these facilities will be conducted consistent with relevant and appropriate RCRA Subpart G closure requirements, 40 CFR Part 264, and will be protective of human health and the environment.

b. The analysis of whether specific RCRA requirements are relevant and appropriate to the remedial action does not take into consideration characteristics of the site which should influence such determinations, such as the following: 1.) the site experiences a higher rainfall than would be typical of mining sites across the U.S. (and thus, the exclusion of extraction and beneficiation waste from Subtitle C regulations may not be appropriate for the Bunker Hill Site; 2.) the proximity of the Bunker Hill Site to both ground water and drinking water sources; 3.) the proximity of the Bunker Hill Site to densely populated areas; 4.) the proximity of the Bunker Hill Site to sensitive environments.

***U.S. EPA RESPONSE # TM-4b:** U.S. EPA has considered the characteristics of the Site compared to a "typical" mining site when making determinations regarding the relevance and appropriateness of RCRA requirements and the degree of protectiveness afforded by various remedial actions. For example, although high concentration extraction and benefication material accumulations (such as lead and zinc concentrates) are Bevill exempt, U.S. EPA is requiring treatment of these materials prior to consolidation in the Lead Smelter Closure when concentrations exceed Principal Threat Thresholds. Please also see U.S. EPA RESPONSE TM-1.*

5. The Tribe notes that the U.S. EPA's definition of the "Area of Contamination" on the Bunker Hill Site has expanded from the original definition in the FS, which included the Smelter Complex, MOA, and CIA, to a definition which encompasses the entire site (see Page 3, paragraph 4, Technical Memorandum). We must express our disappointment in the U.S. EPA's decision to avoid compliance with RCRA Subtitle C requirements by interpreting this term in the broadest sense possible.

A more conservative, and protective interpretation of "Area of Contamination" (Areas of Contamination) would recognize several Area of Contaminations onsite such as the lead smelter, zinc plant, phosphate fertilizer plant, the MOA, CIA, Smelterville flats, railroad right-of-ways, etc. Each of these areas contain very high levels of contamination and are separated from one another (and other possible "Areas of Contamination") by lesser, residual contamination. The areas may be considered discrete, widely separated areas of contamination when the concentration of contaminants in these areas are compared to the concentration of contaminants between and surrounding these "units".

U.S. EPA RESPONSE # TM-5: The U.S. EPA's determination of the Area of Contamination is consistent with the NCP, 55 Federal Register 8758 - 8760 (March 8, 1990) and current guidance. The selected remedial actions are protective of human health and the environment. Also, this Technical Memorandum notes that the referenced Area of Contamination discussion states: "U.S. EPA does not plan to allow high level materials to be moved or relocated to an area of lower level contamination. However, lower level materials of contamination can be relocated to an area of higher levels of contamination".

6. The Technical Memorandum states (Page 4, paragraph 1): "To ensure that the selected remedial actions are protective..."high" level or Principal Threat materials will be consolidated in one common area...and low level materials will also be consolidated under one common area....the U.S. EPA does not plan to allow high level materials to be moved or relocated to an area of lower level contamination." Actions to prevent the combination of high level and low level waste in a common area alone do not ensure that the remedial actions are protective. To ensure "protectiveness", the U.S. EPA must require the incorporation of technical designs which will prevent the migration of contaminants. Neither the unit referred to as the Smelter Complex cap, nor the one referred to as the CIA cap are adequately designed to ensure that contaminants will not migrate out of the unit; neither unit will be designed with double liners.

U.S. EPA RESPONSE # TM-6: The U.S. EPA disagrees. Both the CIA and Smelter Complex closures will be designed and operated to minimize contaminant migration and direct contact. Minimum Technology Requirements (MTRs) (i.e., double liner) are <u>NOT</u> relevant and appropriate for closure of existing facilities. (See OSWER Directive 9234.2-04FS.) Please also see U.S. EPA RESPONSE TM-1.

7. The discussion of the applicability of LDRs fails to address materials and wastes which are hazardous wastes, but are not identified as "Principal Threat Materials". The term "principal threat materials" is not synonymous with RCRA hazardous waste. A large portion of the wastes considered "low level" by the authors of the FS may be RCRA hazardous waste or exhibit characteristics of hazardous waste (including mixtures). For example, according to page 3 of the Technical Memorandum, the mixed wastes in the Smelter complex and other areas of the site, are considered non-excluded wastes, and thus potentially hazardous waste. Unfortunately, testing (TCLP) has not been required by the U.S. EPA or been performed to determine which of these low level wastes are RCRA hazardous waste and thus subject to LDRs.

U.S. EPA RESPONSE # TM-7: As noted previously in U.S. EPA RESPONSES TM-1 and TM-4, all materials that are not considered high volume/low toxicity will be consolidated with Smelter Complex closures that will be designed and operated consistent with RCRA Subpart G closure requirements, 40 CFR Part 264. Regardless, U.S. EPA has not yet promulgated LDRs for mineral processing wastes.

8. The Technical Memorandum also erroneously confuses the "Principal Threat Materials" with mineral processing materials (see page 4, paragraph 2). According to the text on page 3, mineral processing materials (presumably, the authors are using this term to refer to Bevill exempt material) have not been distinguished from other (non-exempt) materials onsite. Therefore, there is no support for the proposition that all principal threat materials are exempt from LDRs and regulation under RCRA Subtitle C.

U.S. EPA RESPONSE # TM-8: LDRs are only triggered when materials are treated ex situ or will be land-disposed outside of the Area of Contamination, and then only when LDRs have been promulgated for the waste being treated.

9. The Technical Memorandum states that "It is expected that the treated high level wastes will pass TCLP" (page 4, paragraph 2). Information provided in the FS does not support this presumption. Without supporting data, the U.S. EPA should take a more protective and conservative approach than the one proposed under Alternative 3 (the U.S. EPA's preferred alternative).

U.S. EPA RESPONSE # TM-9: Treatability testing is currently ongoing and U.S. EPA will ensure that an appropriate design mix is established during Remedial Design.

10. It is stated on page 4, paragraph 2 that if the treated high level wastes does not pass TCLP and thus fails the LDR requirements, a treatability variance will be issued. The Tribe suggests that, if the treated high level wastes cannot pass TCLP that the wastes should be disposed of in a RCRA designed landfill to better ensure the migration of contaminants is prevented. Simply granting a variance given this scenario does not protect human health and the environment.

The text also suggests that the untreated waste will not pass TCLP: "...a treatability variance...will be issued, since the treated materials [which under this scenario have failed the pass TCLP] will be less leachable than the untreated materials; and therefore present a lower risk of release and level of exposure." (page 4, paragraph 2). Wastes which can not pass TCLP must be handled as hazardous waste and appropriate steps taken in the proper disposal and/or stabilization of such wastes.

Furthermore, the justification for a treatability variance suggested in the Technical Memorandum ("..since the treated materials will be less leachable than the untreated materials.") is not one recognized under 40 CFR 268.44. The RCRA regulation addressing "Variance from a treatment standard" states "that the applicant for a site specific variance must demonstrate that because the physical or chemical properties of the waste differs significantly from the waste analyzed in developing the treatment standards, the waste cannot be treated to specified levels or by the specified methods."

U.S. EPA RESPONSE # TM-10: TCLP testing is not applicable in this instance because it is not representative of the conditions at the Site. Rain water leaching will be used instead because it is more representative of Site conditions. Treatment which meets the rain water leach test will be more protective given the Site conditions.

11. The Technical Memorandum states (page 5, paragraph 1): "...because of the Areas of Contamination and the Bevill issues, 40 CFR Part 264 of Subpart N requirements (for hazardous waste landfill) may not be applicable [to the engineered repositories proposed under Alternatives 2 and 4]."

a. This statement implies that the wastes to be consolidated in the engineered repository are Bevill-exempt wastes. However, the failure of the U.S. EPA to require the identification of exempt and non-exempt waste onsite should preclude the agency from later using the Bevill amendment exemptions as justification for finding specific RCRA requirements non-applicable. The world of Bevill-exempt waste onsite remains unknown.

U.S. EPA RESPONSE # TM-11a: U.S. EPA is <u>not</u> choosing an engineered repository. The comment regarding the identification of exempt and non-exempt wastes has been addressed in earlier U.S. EPA responses. Please see also U.S. EPA RESPONSE TM-1 above.

b. The Tribe does not understand how the Areas of Contamination issue affect the determination of the applicability of the design requirements in 40 CFR 264 Subpart N. According to a Memorandum from Catherine Massimino to Nick Ceto, dated Jan. 3, 1992, while the Area of Contamination would be viewed as an existing unit, minimal technological requirements are required for new units, lateral expansions and replacement of existing units. 40 CFR 264.301(c) states: "The owner or operator of each ...new landfill unit at an existing facility, each replacement of an existing landfill unit...must install two or more liners and a leachate collection system above and between the liners." The engineered repositories proposed under Alternatives 2 and 4 are, according to the text in the Technical Memorandum, "newly constructed hazardous waste landfill[s]."

U.S. EPA RESPONSE # TM-11b: Comment noted. U.S. EPA is <u>not</u> choosing an engineered repository as a part of the selected remedy.

12. The Tribe is disappointed in the U.S. EPA's failure to identify the specific design requirements it believes to be relevant and appropriate with respect to the wetland treatment system. The expected degree of protectiveness inherent in the design of the treatment systems remains unknown.

U.S. EPA RESPONSE # TM-12: U.S. EPA has identified performance standards in the ROD. More specific design requirement will be developed in the remedial design phases of this project.

13. The Technical Memorandum (page 7, paragraph 3) suggests that closure requirements (for waste in place) are not applicable to existing landfills due in part to "Bevill issues". As mentioned above, the U.S. EPA's failure to require the identification of and distinction between Bevill and non-Bevill waste onsite, should preclude it from later stating that RCRA requirements are not applicable because the wastes are Bevill exempt. The world of Bevill exempt waste onsite remains unknown.

U.S. EPA RESPONSE # TM-13: Please see U.S. EPA RESPONSE TM-1 above.

14. The Tribe is disappointed in the U.S. EPA's failure to identify the specific closure requirements it believes to be relevant and appropriate with respect to the remedial action. The expected degree of protectiveness offered by the closure design of various units onsite remains unknown.

U.S. EPA RESPONSE # TM-14: The performance standards for closure are specified in the ROD. More specific requirements will be developed in the remedial design phase of this project.

15. The Tribe is concerned about the hybrid closure (referred to on page 7, paragraph 2) for the Smelter cap or the CIA cap. Although, only "low level" wastes are to be consolidated under the CIA cap, these low level wastes have not been tested to determine if they pass the TCLP. The degree of threat posed to ground water by low level wastes under the CIA cap can not be adequately determined without appropriate testing. The hybrid closure ("alternative land disposal closure") are relevant and appropriate only in situations where the wastes being contained is known not to pose a threat to ground water (see 53 Fed. Reg. 51446).

U.S. EPA RESPONSE # TM-15: The specific types of hybrid closures referred to are illustrations of possible closure approaches. The applicable and relevant closure requirements depend on the specific site conditions. In this instance, U.S. EPA has selected closure requirements which will minimize ground water and surface water contamination through the use of low permeability caps. Leachate collection is a component of the Smelter Complex closure.

16. The Technical Memorandum states (page 8, paragraph 3): "However, offsite seeps and loadings and the widespread existence of jig tailings onsite are expected to inhibit immediate compliance with certain ...ARARs in some areas of the site." Immediate compliance with surface water and ground water ARARs is not expected; compliance within a reasonable time is expected. Information in the FS and related technical memoranda indicates that the surface water and ground water ARARs will not be met, within a reasonable time period, under any of the alternative remedial actions evaluated. Therefore, the U.S. EPA should develop an alternative that does attain all ARARs onsite within a reasonable time frame. The time frame

should be defined by the U.S. EPA. If the U.S. EPA finds that it is technically impracticable from an engineering perspective to attain an ARAR, the ARAR must be waived and an alternate clean up level established[2].

Footnote #2: The Tribe believes the failure of the U.S. EPA to require an analysis of alternatives which addresses all known onsite sources of contamination (i.e. dispersed jig tailings and mixed wastes), addresses surface water contamination entering the site from upstream sources, and incorporates both recycling, reprocessing, or treatment to reduce toxicity, mobility, and volume, and disposal in an engineered repository which meets the substantive requirements of RCRA for landfills, should preclude the agency from including a "contingency waiver" in the ROD.

The Technical Memorandum also suggests that the attainment of all ARARs is dependent on offsite programs. We can find no legal justification for basing the attainment of ARARs on offsite action not addressed under CERCLA. If ARARs cannot (because of technical impracticability) be attained, waivers must be granted and alternate clean-up levels established.

The Tribe suggests that the answer to the dilemma of "offsite seeps and loadings" is to recognize that the "facility" encompasses contaminated areas and sources upstream of the Bunker Hill Superfund Site boundaries. The Tribe also maintains that the facility encompasses areas downstream of the site boundaries where hazardous substances have come to be located.

U.S. EPA RESPONSE # TM-16: U.S. EPA recognizes that the attainment of federal Drinking Water ARARs in the valley aquifer system will depend, in part, upon the success of upstream water quality improvement initiatives. The ability to achieve such ARARs at all points within the Site cannot be determined until the remedial actions outlined in the ROD have been effective in meeting performance standards (specified in Section 9 of the ROD) and upgradient efforts have been implemented. If the selected remedy cannot meet these ARARs and contingent actions described in the ROD have been instituted, the ARAR will be waived based upon technical impracticability.

17. The Technical Memorandum states (page 8, paragraph 4): "It is expected that these standards will be met in many areas of the site over time through achievement of remedial action specific performance standards developed for this remedy." The performance standards have not been identified in the FS and/or Proposed Plan. The Tribe is not comfortable with the U.S. EPA's assurance that the RAOs and ARARs will be attained through achievement of unknown performance standards.

U.S. EPA RESPONSE # TM-17: The performance standards for ground water and surface water are identified in the ROD.

18. The Technical Memorandum states (page 9, paragraph 2) that portions of RCRA Subtitle C ground water monitoring requirements may be relevant and appropriate to Alternatives 2, 3, and 4. The Tribe is disappointed in the U.S. EPA's failure to identify the specific requirements that are recognized as ARARs and will be complied with.

U.S. EPA RESPONSE # TM-18: Specific monitoring requirements will be developed during the remedial design phase of this project.

19. The Technical Memorandum states (page 9, paragraph 4): "National primary and secondary ambient air quality standards...for particulate matter may be applicable..." (emphasis added). The Tribe requests more clarification on when the NAAQS for particulate matter will be applicable and when they will not be applicable.

U.S. EPA RESPONSE # TM-19: National Ambient Air Quality Standard are applicable. See Table 10.1 in the ROD.

20. The Tribe requests clarification on the status of the Federal Endangered Species Act (16 U.S.C. 1531-1543; 50 CFR Parts 17, 401; 40 CFR 6.302(h)) and the Federal Migratory Bird Act (16 U.S.C. 703-712; and related regulations) as ARARs for remedial actions on the Bunker Hill Site. We believe these laws provide essential protection to important species of fish and wildlife in the Coeur d'Alene River Basin.

U.S. EPA RESPONSE # TM-20: Comment noted. Table 10-2 in the ROD has been changed to reflect this comment.

APPENDIX D

COEUR d'ALENE TRIBE OF IDAHO

COMMENTS ON THE RI/FS

July 27, 1992

Mr. John Meyer
U.S. EPA Region 10
Superfund Branch
1200 Sixth Avenue
Seattle, WA 98101

Re: Comments on the Remedial Investigation/Feasibility Study
for the Bunker Hill Superfund Site

Dear Mr. Meyer:

The Coeur d'Alene Tribe is submitting these comments on the Remedial Investigation/Feasibility Study (RI/FS) in the Tribe's oversight capacity of the CERCLA remediation action being conducted on a portion of the Bunker Hill facility. These comments are submitted recognizing that the trust responsibility or fiduciary duty owed the Coeur d'Alene Tribe of Idaho by the United States of America through its Environmental Protection Agency includes protection of the Coeur d'Alene Tribe's cultural, spiritual, traditional, and natural resource rights and interests.

The Tribe requests that EPA consider restoration of the natural resources in the Coeur d'Alene Basin as a goal for the remedial action. The proposed alternatives fall substantially short of this goal. Furthermore, none of the proposed remedial alternatives in the FS fully comply with ARARs or meet the threshold criteria of being protective of human health and the environment. The remediation should in no way constitute an irretrievable and irreversible commitment of resources.

This letter with attachments illustrate our dissatisfaction with the RI/FS studies and documents. We have not attempted to comment on every page of the RI/FS. Detailed comments have been provided to EPA throughout the RI/FS process by way of comment letters, meetings and telephone conferences. Our efforts are best spent on commenting on what the Tribe believes are the major deficiencies in the work performed for the "Bunker Hill Superfund Site" to date. This letter should not be interpreted to mean that the Tribe agrees with portions of the RI/FS documents not addressed in the following pages. We regret that several of our primary comments have neither been implemented nor addressed in the RI/FS documents. These studies and the related documents are the foundation for the Remedial Plan and Record of Decision. Deficiencies in these studies impact our level of confidence in the Remedial Plan.

We have summarized the Coeur d'Alene Tribe's major concerns and comments related to the RI/FS for the Bunker Hill Superfund Site. Many of these concerns were communicated in earlier letters, but remain unaddressed. We expect that each of the concerns listed below will be addressed in the Record of Decision (ROD) for the site. Also, please refer to the following letters previously sent to you regarding the RI/FS documents: Feasibility Study Outline (our letter dated 2/14/91); Draft Feasibility Study (our letter dated 3/28/91); Master Plan for Remediation of the Bunker Hill Superfund Site (our letter dated 3/28/91); Draft Ecological Risk Assessment (our letter dated 5/31/91); and Draft Residential Soils Feasibility Study for the Populated Areas (our letter dated 6/24/91); Technical Memoranda (our letter dated 11/8/91); Remedial Investigation/Feasibility Study (RI/FS; our letter dated 9/11/91, with attachment; and Revised Draft Feasibility Study (our letter dated 1/17/92). We hereby request that this letter (with attachments) and the above referenced letters be included as part of the Administrative Record for the Bunker Hill Superfund Site.

- The "site" as addressed by the RI/FS and the proposed CERCLA action does not encompass the entire "facility" as defined by CERCLA Section 101(8). EPAs activities have been limited to a 21-square-mile area, "the Bunker Hill Site". The RI does not consider releases entering the site from upstream areas, contaminants being deposited in or transported through the site, or past releases which have come to be located, deposited, or otherwise placed downstream of or in locations outside the boundary of the Bunker Hill Site. The FS does not consider remediation of contaminated areas/media in large portions of the facility. Refer to our letters dated 9/11/91 and 1/17/92.

- The FS fails to include a complete, detailed analysis of ARARs and TBCs. The FS does not provide adequate information on how these laws, regulations, and guidelines were considered during the development and screening of remedial alternatives. The listing of ARARs provided in the FS does not identify the specific requirements to be complied with and is, therefore, inadequate for purposes of an FS.

- The RI document does not address most of the Tribes' prior comments on the draft RI nor does the document provide the detail and specific data necessary to analyze and evaluate remedial alternatives. This deficiency is exemplified by the fact that even though extensive studies of the ground and surface waters have been performed at the site, significant data gaps still remain and available data have been insufficiently and incompletely evaluated. As a result major uncertainties remain with regard to ground and surface water flow and loadings, and the correlation of these media with specific contaminant sources.

- The RI/FS fails to adequately address contaminated river sediments. Sufficient, reliable data on sediments at the site was not collected during the RI studies. Analysis of existing information on sediment contaminants, and the potential for migration of these contaminants was not performed. The impacts of contaminated sediments on ground water and surface water quality remain unknown. The FS should have, but does not, seriously consider engineering or institutional controls of these sediments. Furthermore, safe threshold levels have not been established for sediments. Since ARARs do not exist for sediment, information gained through the risk assessments should have been used to determine these levels. Refer to our letters dated 3/28/91, 5/31/91, 9/11/91, and 1/17/92.

- The FS fails to state and support adequate remedial action objectives (RAOs) and remedial action goals[1]. The RAOs set forth in the FS do not specify the contaminants of concerns nor the acceptable contaminant level or range of levels for each exposure route (i.e. remediation goals). Furthermore, the environmental receptors are not specified in the RAOs addressing risk to the terrestrial and aquatic ecosystems. With respect to ground water and surface waters, the FS fails to establish clean-up levels; rather, the document just simply repeats several times that the remedial action will not meet the ARARs (MCLs/MCLGs for ground water and FWQC for surface water). With respect to soils and surface materials, no remediation goals (clean-up levels) are stated. Clean-up levels for contaminated sediments are not addressed in the RAOs, and the RAOs for air fail to address any of the contaminants of concern other than lead.

> *Footnote #1: The preamble to the National Contingency Plan (55 Fed. Reg. 8712) states that the remedial action objectives for protecting human health and the environment should specify contaminants and media of concern, potential exposure pathways and preliminary remediation goals. The preliminary remediation goals are concentrations of contaminants for each exposure route that are believed to provide adequate protection.*

The RAOs further fail to correctly identify points at which the remedial goal (cleanup level) should be attained. In 53 Fed. Reg. 51426, it is stated: "For ground water, remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when waste is left in place....For surface waters, the selected levels should be attained at the point or points where the release enters the surface waters." The RAOs in the FS fail to ensure that ground water will be remediated to an acceptable level throughout the plume, or at least "at and beyond the edge of the waste management area", and that FWQC (or alternate concentration levels) will be attained at any point along the SFCDR.

As a result of the failure of the FS to state acceptable RAOs and remedial goals, the analysis of whether or not the alternative remedial actions attain the RAOs and meet the threshold criteria of being protective of human health and the environment is unreliable. Refer to letters dated 2/14/91, 3/28/91, 5/31/91, 9/11/91, and 1/17/92.

- The proposed waivers for ground water and surface water ARARs are not justified by information provided in the FS. An alternative that does comply with all ARARs was not included in the screening process. Such an alternative must be seriously considered and analyzed before a waiver based on technical impracticability can be proposed or granted.

If an ARAR waiver is granted, the contaminants of concern which are expected to continue to exceed the pertinent standard or criteria must be specified. The FS implies that a waiver should be granted for all ground water and surface water contaminants of concern; however, the standards and criteria for many of these contaminants can be met if the site is adequately remediated. Refer to our letters dated 2/28/91 and 1/17/92.

- The mandate that human health and the environment be protected cannot be waived. All remedial action alternatives that pass through screening, whether or not ARAR waivers are granted, must be protective of human health and the environment. The FS fails to adequately demonstrate that there is minimal risk posed to humans and ecological receptors by the residual levels of contamination under the proposed alternatives. For example, the ecological risks which are posed by the contaminated tailings, subsurface contaminant sources, soils, ground water, and surface waters left in place under each alternative scenario have not been determined. This determination should have strongly influenced the screening and selection of remedial actions. Refer to our letters dated 3/28/91, 9/11/91, and 1/17/92.

- The contaminants left in place in the populated and non-populated areas will continue to impact ground and surface waters at the site. Thus, implementation of any of the remedies evaluated will limit future uses of waters on the site and on the facility downstream of the Bunker Hill Superfund Site boundaries. The RI/FS fails to adequately address this issue. Refer to our letters dated 6/24/91 and 1/17/92.

- The final remedial action must ensure that concentrations in the South Fork of the Coeur d'Alene River (SFCDR) and its tributaries are reduced to levels which allow the restoration and long-term protection of the Coeur d'Alene watershed. To this end, the Federal Water Quality Criteria (FWQC) are identified as ARARs in the FS, as required under CERCLA (Section 121). Unless it is determined by the ecological risk assessment that more stringent criteria are needed to allow restoration of the ecosystem, the FWQC must be goals for the remediation of the surface water on the facility.

However, as concluded by results presented in the "Post-Remediation Water Quality Projection's" Technical Memorandum, none of the alternatives considered in the FS will meet the FWQC or ensure long-term protection of the Coeur d'Alene watershed. This deficiency results from the failure of the FS to seriously consider treatment of surface water flows greater than base flow and site wide ground water contamination and to ensure thorough remediation of contaminant sources. The FS should have, but did not, consider treatment and source control technologies which would mitigate upstream loadings coming onto the site. The FS further fails to seriously consider a remedial alternative which is conducive to the restoration of fish habitat in the tributaries, such as the removal of contaminated sediment and comprehensive source control. Refer to our letters dated 2/14/91, 3/28/91, 5/31/91, 6/24/91, 9/11/91, and 1/17/92.

- Remedial action alternatives which adequately address the exposure pathways of bioaccumulation and biomagnification are not considered in the RI/FS. Refer to our letters dated 3/28/91, 5/31/91, and 1/17/92.

• The FS does not seriously consider the need for biological monitoring (terrestrial and aquatic) to determine the health of environmental receptors. Biological monitoring should be performed prior to, during and following remedial actions at the site. Refer to our letters dated 2/14/91, 5/31/91/ 9/11/91, and 1/17/92.

• The FS fails to consider actions to treat and remediate the lower zone and major portions of the upper zone ground water. Refer to our letters dated 2/14/91, 3/28/91, and 1/17/92.

• Various methods are used and attempts made to avoid RCRA compliance throughout the RI/FS. For example, the RI/FS does not distinguish between RCRA and non-RCRA wastes, including Bevill exempt wastes, onsite. Nor does the RI/FS characterize contaminated soils and materials which are mixtures of RCRA and non-RCRA wastes. This failure to adequately characterize contaminated soils and materials undermines the determination of whether or not specific requirements are relevant and appropriate to the remedial action.

This effort to avoid RCRA Subtitle C requirements has influenced the remedy selection process in undesirable ways. This is exemplified by the failure of the FS to evaluate a remedial alternative which includes the treatment of all RCRA hazardous wastes to be consolidated onsite and the design of a landfill which meets all the substantive requirements of RCRA Subpart N, including a double liner.

• Treatability studies have not been performed for the waters and many of the wastes which may require treatment. Treatability investigations are an integral part of the RI/FS process, and are conducted in order to select an alternative that will meet remedial goals with an acceptable level of certainty. Refer to our letters dated 3/28/91, 9/11/91, and 1/17/92.

• The FS fails to specify action levels (clean-up levels) to which the contaminants of concern in soils, sediments and wastes in the smelter complex, mine and concentrator area, right-of-ways, floodplain, hillsides, and other areas will be remediated. The FS failed to clarify the assumptions regarding post- remediation land uses which were made in developing the proposed alternatives. Refer to our letters dated 3/28/91, 9/11/91, and 1/17/92.

• The FS fails to consider and evaluate a remedial alternative and technologies which involve the total removal and/or treatment and proper disposal of all contaminated materials at the site (including the tailings in the valley floor, surface and subsurface wastes and soils in the smelter complex and mine areas, contaminants in non-populated area Right of Way, and materials in the Central Impoundment Area) and restoration of the area to its pre-impacted condition, to the fullest extent possible. This alternative would require minimal long-term maintenance and minimize reliance on institutional controls. Refer to our letters dated 9/11/91 and 1/17/92.

• The FS fails to establish effluent goals for the surface and ground water treatment systems proposed in the FS. These treatment systems are innovative and, thus, in order to ensure their performance and verify their adequacy in achieving the remedial action goals, laboratory and/or pilot-scale studies should have been performed. No such studies were performed during the FS.

We have a number of concerns regarding the proposed water treatment systems. The estimated wetland removal rates, for a number of reasons, seem unrealistic. These systems will capture and treat only a small percentage of the surface water and ground water contaminant loadings. In addition, doubts remain about the permanence of the systems, their ability to treat the water to levels which are protective, their impact on terrestrial and aquatic life, and their operation and maintenance requirements. Refer to our letters dated 3/28/91, 9/11/91, and 1/17/92.

- The FS fails to consider and evaluate an alternatives which include offsite disposal of contaminated materials. The removal and offsite disposal alternatives should have included various and perhaps several repository, reprocessing, and treatment locations. The FS assumes that one large repository must be available to handle the large volume of different waste types found on the site in order to make this option feasible. Furthermore, offsite disposal of contaminated materials may be important for any remedial action for which restoration is a goal. Refer to attachments to our letters dated 9/11/91 and 1/17/92.

The Tribe has an interest in the restoration of natural resources to their pre-impacted condition. In order for the remedial efforts to be effective in the long-term, the levels of contaminants entering the media, becoming mobilized on the site, and leaving the site following remedial action must allow aquatic and terrestrial biota to thrive on the site and in the basin for generations to come.

Sincerely,

Ernest L. Stensgar, Chairman
Coeur d'Alene Tribal Council

NOTE: U.S. EPA has not addressed the individual comments in this transmittal letter. U.S. EPA believes that all the issues raised in this letter are discussed in the attached comments or other comments in the responsiveness summary.

COMMENTS REGARDING THE LISTING AND ANALYSIS OF ARARS AND TBCS IN THE FINAL FS FOR THE BUNKER HILL SUPERFUND SITE

These comments refer specifically to portions of Section 8 which address Overall Protection of Human Health and the Environment (8.2.1) and Compliance with ARARs (8.2.2); Appendix J; and the response to "Agency Comments Regarding ARARs Analysis in the Draft Feasibility Study Report".

1. The FS fails to provide a detailed analysis of ARARs and TBCs.

The rationale for the decision that a chemical-, location-, or action-specific requirement is applicable, or is relevant and appropriate for that specific site, should be documented for each remedial action alternative that passes through the screening and into detailed analysis. The rationale should include an explanation of the analysis leading to the determination of applicability, or relevance and appropriateness. EPA's "CERCLA Compliance With Other Laws Manual" states that this documentation should always be supplied in an Appendix to the RI/FS report in the discussion of the analysis of Federal and State ARARs.

Appendix J to the FS does not discuss the analysis of ARARs. The appendix simply lists the various laws and regulations that are considered potential ARARs, along with a very brief description of the purpose or objective of the law/regulation. The FS does not describe the specific requirements that effect the design and screening of the various alternatives. No information is provided on whether the laws/regulations are considered "applicable" (and thus must be complied with wholly) or "relevant and appropriate" (in which case only specific requirements are important).

Although more information is provided in Section 8 with respect to ARARs, the analysis of the laws and regulations and their specific requirements is still inadequate. For example, on Page 8-63, paragraph 3, where Section 404 of the Clean Water Act (Dredge and Fill) is listed as an ARAR for Alternative 3, but the requirements are not described; page 8-63 where five location-specific ARARs are listed, but requirements imposed by them are not discussed; and Page 8-66, where "EPA's policy" regarding PCB disposal is alluded to as an ARAR, but no further information provided. The list of State ARARs does not include an analysis of which ones are "applicable" and which ones are "relevant and appropriate", or information on how these state ARARs influence the design and selection of alternative remedial actions. This is not meant to be an exhaustive description of ARARs that are not described in detail; this deficiency in the analysis of ARARs is found through Section 8 and Appendix J.

***U.S. EPA RESPONSE # 1:** Section 10 of the ROD identifies the ARARs for the remedial action. Tables 10-1 through 10-6 identify the ARARs and specify which are "applicable", "relevant and appropriate", or "to be considered". These tables further describe the general requirements of the ARAR and identify the location.*

U.S. EPA expects this remedial action to comply with these ARARs in accordance with Section 121(d) of CERCLA. These ARARs, which present complex requirements, have been explained and analyzed in detail in the Feasibility Study and the "Technical Memorandum Evaluating Regulatory Requirements for The Bunker Hill Site", which are available in the Administrative Record. These analyses are not meant to be exhaustive nor are they designed to diminish the importance of each of the ARARs listed in tables 10-1 through 10-6 of the ROD.

2. There are several inconsistencies in the FS regarding what is considered an ARAR. For example in Section 8, the Idaho Mine Waste Disposal regulations are identified as ARARs for 2,3, and 4, but the regulations are not included in the list of ARARs provided in Appendix J. This is also true for the Surface Mining Control and Reclamation Act. Different citations are provided for regulations governing the disposal of asbestos in different pages of Appendix J.

Only a small subset of the State ARARs listed at the end of Appendix J are included in the listing of ARARs by alternative in Appendix J and Section 8. It appears as if the importance of several State ARARs has not been seriously considered in the analysis of alternative remedial actions.

Appendix J and Section 8 lists the Federal Endangered Species Act as an ARAR for Alternatives 2, 3, and 4; however, in the comments responding to "Agency Comments Regarding ARARs Analysis in the Draft Feasibility Study Report" (page 6) (attached to the final FS), it is stated the "no endangered species have been identified within the site". If this statement were true, it would indicate that the Endangered Species Act is not an ARAR. Please note that, according the U.S. Forest Service, there have been sightings of grizzly bears (listed species) and wolverines (threatened species) in the area of Shoshone County, and that golden eagles and bald eagles (listed species) are found seasonally in areas near the Bunker Hill Site (see Jacobs Engineering Group, Inc., 1989, Human Health Risk Assessment Protocol for the Populated Areas of the Bunker Hill Superfund Site).

U.S. EPA RESPONSE # 2: The ROD contains the final determination of ARARs for this remedial action. It recognizes that the Surface Mining Control and Reclamation Act, the Endangered Species Act, and Section 404 of the Clean Water Act are ARARs for this remedial action. Furthermore, these State ARARs which were identified by the State of Idaho and are recognized as ARARs are listed in Tables 10-4 through 10-6 of the ROD.

3. The FS fails to list and consider the following ARARs which are important to the Bunker Hill Superfund Site:

Idaho Code, Section 36-201, Endangered Species, which protects species of plants and animals identified for special protection by the Idaho Fish and Game Commission. Since different species are identified under the state endangered species law and the federal Endangered Species Act, the federal law does not supersede this state ARAR;

Idaho Code Sections 36-901 through 36-909, Protection of Fish, which prohibits the deposition, placement, etc. of any toxicant, chemicals, or other materials that may tend to destroy, kill or drive away fish;

16 USC 703-712, Federal Migratory Bird Treaty Act, which prohibits unauthorized killing of migratory birds.

U.S. EPA RESPONSE # 3: The selected remedial action is designed to reduce the toxicity and mobility of the contamination located within and emanating from the Site; thereby providing protection for endangered species identified by federal and state laws designed to protect such endangered species. Moreover, the federal Migratory Bird Treaty Act has been identified as an ARAR in Table 10-2 of the ROD. The State of Idaho did not identify Idaho Code Sections 36-901 through 36-909 as an ARAR. Thus, U.S. EPA did not include them as an ARAR.

Several RCRA Subtitle C requirements which are relevant and appropriate to proposed remedial alternatives (see Comment # 4, below).

4. Several requirements of RCRA Subpart C (hazardous waste) should be reconsidered, and complied with as ARARs in the interest of protecting human health and the environment.

In the preamble to the National Contingency Plan (March 8, 1990), EPA states "...a decision about whether a requirement is relevant and appropriate is made on a case-by-case basis, based on the specific characteristics of the [mining] site and the release. There may be some [mining] sites where the site circumstances differ significantly from those which caused EPA to decide that Subtitle C regulation is not warranted and where certain requirements are appropriate and well-suited to the site or portions of the site". (page 55 Fed. Reg. 8764).

To determine whether RCRA Subtitle C requirements are relevant and appropriate requirements with respect to the extraction and beneficiation wastes at a particular CERCLA site, the characteristics of the site must be compared to those of a "typical mining site". Site characteristics of a typical mining site were summarized and compared to those of a typical hazardous waste site in 51 Fed. Reg. 24,500 (July 3, 1986). These site characteristics are compared to those of the Bunker Hill Site below:

Typical Mining Site	Typical HzWaste Site	Bunker Hill
1. Climate		
Drier- annual net recharge 0-2 inches	Wetter- annual net recharge 5-15 inches	Wetter- annual net recharge not known: annual precipation 30 in.
2. Ground water		
Site isolated from gw source - more than 30 ft.	Site closer to gw source - 30 ft or less	Site closer to gw source -less than 30 ft.
3. Drinking water		
Site isolated from dw source for large population	Site closer to dw source (within 5 miles) for population of 15,000+	Site closer to dw source, within 5 miles for population of 6,500+
4. Population		
Less densely populated - less than 200 within 1 mile	More densely populated - average 200 within 1 mile	Population of over 6,500 within site
5. Proximity to sensitive environment		
Usually closer to sensitive environments	Usually no adverse impact on sensitive environments	Close to sensitive environments (for example wetlands)

The Bunker Hill Superfund Site clearly differs from the typical mining site described in the July 3, 1986 Federal Register. Therefore, the rationale used to exclude the mining wastes from requirements of RCRA Subtitle C does not apply to the circumstances at the Bunker Hill Superfund Site. The technical requirements under Subtitle C are important with respect to protecting human health and the environment from the negative impacts of mining wastes at the Bunker Hill Site. RCRA Subtitle C requirements that should be complied with as ARARs under the proposed Alternative 3, for example, include the following (this list is not intended to be exhaustive):

For Alternative 3

a. Smelterville Flats

- Testing of materials excavated for RCRA hazardous waste characteristics to determine proper handling and disposal (40 CFR 261);

  Land Disposal Restrictions (40 CFR 268);

  Construction of New Surface Impoundment 40 CFR 264.220; 40 CFR 264.221; and ground water monitoring 40 CFR 264.91 - 264.100; Dike maintenance and inspection requirements 40 CFR 264.226 through 264.228.2

  OR

  Chemical, Physical and Biological Treatment, 40 CFR 265.400 through 265.406 (RCRA, Subpart Q)

  Miscellaneous Units, 40 CFR 264.600 through 264.603 (RCRA, Subpart X)

b. CIA

  Testing waste for characteristics of RCRA hazardous waste (40 CFR 261) to determine proper handling and disposal 40 CFR 261;

  Capping requirements for surface impoundments 40 CFR 264.228(a), 40 CFR 264.117(c), 40 CFR 264.228(b)

  Closure with Waste in Place (jig tailings are placed in CIA) 40 CFR 264.228 (a)(2); 40 CFR 264.258(b); 40 CFR 264.310

  Closure with No Post-Closure Care (for gypsum ponds) 40 CFR 264.111

  Land disposal restrictions 40 CFR 268 (RCRA, Subpart D)

  Footnote #2: Based on the information provided in the Draft FS, the collected water wetland treatment system should be considered a surface impoundment for purposes of RCRA requirements. The system cannot meet the definition of a "wastewater treatment unit," (which is not subject to many of the RCRA Subtitle C requirements) unless the pertinent device meets the definition of a "tank" or "tank system" (see 40 CFR Section 260.11). If however, the authors of the FS can adequately substantiate the claim that the collected water *wetland treatment system is a wastewater treatment unit, 40 CFR 265.400 et al and/or 40 CFR 264.600 et al are an ARAR.*

c. Page Pond

Testing waste (jig tailings from West Page Swamp) for characteristics of RCRA hazardous waste (40 CFR 261) to determine proper handling and disposal 40 CFR 261;

Land Disposal Restrictions 40 CFR 268 (RCRA, Subpart D)

Capping requirements for surface impoundments 40 CFR 264.228(a), 40 CFR 264.117(c), 40 CFR 264.228(b)

Closure with Waste in Place (jig tailings are placed in CIA) 40 CFR 264.228 (a)(2); 40 CFR 264.258(b); 40 CFR 264.310

Closure with No Post-Closure Care (West Page Swamps) 40 CFR 264.111

Land disposal restriction 40 CFR 268

d. Mine Operations Area

Test material accumulations for characteristics of RCRA hazardous waste to determine proper handling 40 CFR 261;

Closure with Waste in Place (mill settling pond) 40 CFR 264.111

e. Smelter Complex

Landfills 40 CFR 264.301 through 264.316 (Subpart N)[3], including liner requirements.

Footnote #3: The FS lists only 40 CFR 264.300.

Information provided in the RI/FS indicate that none of the remedial alternatives proposed provide the margin of safety that RCRA hazardous waste treatment facility design requirements and RCRA hazardous waste testing and handling requirements were are intended to provide. This matter is of great concern because of both the toxic nature of materials being dealt with at the Bunker Hill Superfund Site and the proximity of the site to human populations. Without this margin of safety, it is doubtful that any of the proposed alternatives truly meet the threshold criteria of protecting human health and the environment.

***U.S. EPA RESPONSE # 4:** With respect to RCRA ARARs, U.S. EPA's June 1992 Technical Memorandum Evaluating Regulatory Requirements for the Bunker Hill Site provides an* *extensive discussion of this issue. The reader is referred to that memorandum for further information.*

In general, RCRA has limited applicability at the Site. First, U.S. EPA has determined that the contaminated areas of the Site constitute a single area of contamination (AOC), based upon analytical data that demonstrate the continuous contamination onsite from air deposition and other onsite activities. By definition, relocating, consolidating, and handling of hazardous wastes within this AOC is not "placement" and thus will not trigger potentially applicable Land Disposal Restrictions. Second, extensive areas of the Site are contaminated by Bevill-exempt wastes, which are exempt from RCRA Subpart C requirements. Third, there are currently no applicable requirements for mineral processing wastes.

Notwithstanding, because this Site poses problems similar to those addressed during RCRA "closure", U.S. EPA has determined that certain aspects of RCRA are relevant and appropriate. For example, relevant Subpart G closure requirements will be applied to the Lead Smelter and Zinc Plant closures, including a low permeability cap and leachate collection.

It is noted that RCRA Minimum Technology Requirements (MTRs) only apply to new units, replacement units, and lateral expansions of existing landfills (40 CFR 254.301 (c)). Therefore, an existing landfill or AOC would not be subject to MTR, even if disposal of hazardous waste occurred as part of a CERCLA Action (Reference RCRA ARARs, Focus on Closure Requirements, October 1989, OSWER Directive 9234.2-04FS). Therefore, MTRs such as a double liner are not applicable to closure of the Smelter Complex facilities. U.S. EPA has further determined that these requirements are not relevant and appropriate for this action. Instead, as noted above, U.S. EPA has determined that certain RCRA closure requirements are relevant and appropriate for this action.

U.S. EPA has considered the characteristics of the Site compared to a "typical" mining site when making determinations regarding the relevance of RCRA requirements and the degree of protectiveness afforded by various remedial actions. For example, although high concentration extraction and benefication material accumulations (such as lead and zinc concentrates) are Bevill exempt, U.S. EPA is requiring treatment of these materials prior to consolidation in the Lead Smelter Closure when concentrations exceed Principal Threat Thresholds.

Decisions regarding the relevance of RCRA to closure of Page Pond, the CIA, and the Smelter Complex, and remedial actions selected for the MOA and Smelterville Flats were made primarily based upon insuring protectiveness, not a Bevill/non-Bevill determination. Please see the ROD and Technical Memorandum for additional discussion.

5. The determination of which RCRA ARARs must be complied with at the site should have been made before the screening of alternatives and writing of the Final Feasibility Study.

The FS suggests that this determination will be made after the selection of the preferred remedy: "EPA will make a final determination as to what aspects of the aforementioned RCRA standards are relevant and appropriate for the selected remedy and are to be considered in the design phase." (page 9-49) The degree to which RCRA ARARs must be complied with at the site is a major issue, and should effect, to a large degree, the screening of alternatives. The determination also should influence the analysis of whether or not the alternatives are cost effective. It is inappropriate to delay the analysis of RCRA ARARs until after the screening process.

U.S. EPA RESPONSE # 5: RCRA ARARs were evaluated in the Feasibility Study and the "Technical Memorandum Evaluating Regulatory Requirements". Further refinement of specific RCRA requirements depends, in part, on the remedy selected and the design of the remedy.

6. The FS treats the analysis of "to-be-considered materials" (TBCs) lightly, and does not fully consider the additional protection that may be afforded human health and the environment by the information and guidance provided through these materials.

The FS simply states that "...the possible list of TBCs is unlimited", and suggests that TBCs will be identified at the time of selection of the preferred remedy (page 8-33). However, TBCs which address safe levels of contaminants in the environment (chemical-specific), or which address specific characteristics of the site (location-specific), must be identified before alternative remedial actions are screened and the preferred alternative selected. Comparison of the alternatives to important TBCs should be part of the screening process, especially where no ARARs exist that ensure protection of human health and the environment.

In particular, TBCs should be considered in developing remedial action goals (clean-up levels) for soil/ surface materials, air and sediments. (No ARARs exist for soil/surface materials or sediments; ARARs do not exist for air-borne contaminants other than lead). The FS states that "Certain specific risk-based criteria presented in the Non-Populated Areas Human Health Risk Assessment and Ecological Risk Assessment may be identified as ...TBCs...." (Page 8-35). However, the document does not identify these risk based criteria, nor does the FS discuss specific cleanup levels for soils, air, and sediment contaminants based on these risk based criteria.

The use of TBCs in establishing clean-up levels is also important due to the multiple-contaminants and multiple-pathways on the site. TBCs should be used to modify remediation action goals to address these extenuating circumstances.

U.S. EPA RESPONSE # 6: TBCs are intended to complement the use of ARARs and their use is discretionary rather than mandatory, see NCP preamble discussion at 55 Fed. Reg. 8745-8746 (March 8, 1990). Consideration of Advisories, Guidance, or Criteria that are not ARARs may be useful in developing CERCLA remedies when they help:

1) provide information on leach effects;

2) provide technical information on remedial actions; and,

3) outline policy.

U.S. EPA has determined that information found in the RI/FS, Residential Soils ROD, Non-populated Human Health Risk Assessment (HHRA), Risk Assessment and Data Evaluation Report (RADER), Ecological Risk Assessment, and voluminous supporting technical documents for the Site provide a basis for selecting remedial actions and that extensive analysis of TBCs is not warranted in the FS and the ROD. With respect to the use of TBCs in developing cleanup levels, the HHRA and Ecological Risk Assessment relied heavily on information that could be characterized "TBCs" in analyzing potential risk at the Site.

7. The FS has not adequately and thoroughly considered the risk to human health in its determination that Alternatives 3 and 4 meet the threshold criteria of protectiveness.

It appears that the results of the human health risk assessment had yet to be determined, and thus were not considered in the development of clean-up goals or the screening of alternatives. The FS states that "The results of the risk assessment will be used to confirm or support modifications to the [remediation] goals...." If the results of the human health risk assessment have not been factored into and quantitatively specified in the RAOs and the design and screening of alternatives, an important question is raised: How can the determination that Alternatives 3 and 4 meet the threshold criteria of protection of human health have been conclusively made?

U.S. EPA RESPONSE # 7: Sections 6 through 10 of the ROD discuss the ability of the alternatives evaluated in the Feasibility Study to meet the "threshold" criteria of protectiveness in the findings of the Human Health Risk Assessment and Ecological Risk Assessment. The reader is further referred to U.S. EPA responses to Coeur d'Alene Tribe Proposed Plan comments regarding residual risk.

8. The request for ARAR Waivers in the FS is not adequately justified.

The authors of the FS claim that waivers are justified with respect to the ground water ARARs (MCLs and MCLGs) and surface water ARARs (FWQC) due to technical impracticability. The authors claim that neither the ground water nor the surface water can be cleaned up to a level which attains these ARARs because of upstream sources of contaminants and because of the jig tailings which underlie populated area. Although the first rationale (upstream sources) may justify an "interim measure" waiver, the FS does not provide sufficient information and analysis to support a waiver based on "technical impracticability".

The "technical impracticability waiver" (40 CFR 300.430(f)(1)(ii)(C)(3)) is intended when compliance with an ARAR is not technically practicable from an engineering perspective. An alternative that attains ARARs must be seriously considered and analyzed before the authors can conscientiously claim a waiver of this type. The FS does not consider such an alternative. The implications in the FS is that an alternative that addresses upstream sources and dispersed jig tailings would be inordinately costly and disruptive to the community. Neither or these reasons support the contention that a thorough remediation of site contamination is not technically practicable from an engineering perspective.

If associated costs is the limiting factor, the FS must include a complete analysis of the alternative (that attains ARARs), including a cost estimate. Cost is not a major factor in "technical impracticability" unless compliance would be "inordinately costly". Both standard and innovative technologies should be considered before invoking this waiver[4] (see 55 Fed. Re. 8748). Nor is community disruption a major factor in "technical impracticability". With respect to the possibility of severe community disruption associated with removal of widely dispersed jig tailings, the FS fails to quantify the jig tailings intimately incorporated into the populated portions of the site and the associated contaminant loadings. Many jig tailings and contaminated soils/sediments exist in the river bed and banks and undeveloped parcels of land. It is possible to address these sources of contamination without seriously disrupting the community.

Footnote #4: The FS states: "Because of likely extensive and substantial disruption and short-term risks to the human population and the economic and environmental costs associated with loss of land areas and uses when compared to the lack of risk to humans, remedial actions involving removal or engineering controls in populated areas to address ground water [and surface water] pathways have been screened out in this FS as not technically feasible or appropriate" (page 8-39).

The FS also points to upstream sources of ground water and surface water contamination as reasons for invoking an ARAR waiver[5]. However, the document does not support the contention that there is no technically feasible means of addressing the contamination entering the site from upstream sources. Upstream sources of contamination may, however, justify an ARAR waiver for an "interim measure" (40 CFR 300.430(f)(1)(ii)(C)). The National Contingency Plan allows ARARs to be waived if the alternative is an interim measure and will become part of a total remedial action that will attain ARARs. However, to invoke this waiver, EPA must first recognize that the "Bunker Hill Superfund Site" is just one portion of the facility which includes contaminated lands and waters as far upstream as Mullan, Idaho, and as far downstream as Harrison, Idaho, Lake Coeur d'Alene, and possibly beyond.

Footnote #5: The FS states: "Given the on-going contribution from [upstream] sources under any alternative and the uncertainties as to future improvements in the ground and SFCDR water quality entering the site, it is not possible to predict future attainment of the cadmium MCL identified in previous sections" (page 8-40); and "The RI demonstrates that SFCDR water quality within the site is substantially controlled by loadings from sources upstream of the site, to a degree that even with total elimination of loading from onsite *sources, the FWQC for cadmium, lead, and zinc still would be exceeded in the SFCDR at the site" (page 8-43).*

Finally, in the response to comments ("Agency Comments Regarding ARARs Analysis in the Draft Feasibility Study Report", attached to the FS Executive Summary), the authors imply that they are invoking a waiver based on "Equivalent standard of performance" (NCP, Section 300.430(f)(1)(ii)(C)(4)) with respect to RCRA Section 264 Subpart G. However, information provided in the FS does not support the contention that "the steps to be undertaken at the site will through equivalent mechanisms paralleling the Subpart G regulations, achieve a level of protectiveness equal to that afforded under the Subpart G standards. Thus strict compliance with these standards is not warranted." The specific requirements of these regulations must be compared with the steps to be taken under the proposed alternatives and an explanation provided on how the proposed alternatives achieve the required level of protectiveness.

U.S. EPA RESPONSE # 8: The remedy selected in the ROD is anticipated to meet surface water ARARs within the remediated areas. The remedy selected by the ROD also strives to meet ARARs for the ground water within the remediated area.

Based on information obtained during the Remedial Investigation, and the analysis of remedial alternatives, U.S. EPA and the State of Idaho believe that the selected remedy may be able to achieve the water quality improvement objectives stated above. However, ultimate attainment of Federal Drinking Water Standards (DWS) in the valley aquifer system will in part depend upon the success of upstream water quality improvement initiatives in controlling contaminant loading to the valley aquifer system, as well as onsite actions. Ground water contamination may be especially persistent in the immediate vicinity of contaminant sources, and in portions of the valley aquifer system most strongly influenced by upgradient surface and ground water contamination.

The ability to achieve cleanup goals (DWS ARARs and protection of surface water quality) at all points throughout the valley aquifer system cannot be determined until the remedial actions outlined in this ROD have been effective in meeting their individual performance standards (specified in Section 9 of the ROD), and upgradient efforts to improve water quality have been implemented. If the selected remedy cannot meet DWS throughout the valley aquifer system, notwithstanding upgradient efforts that may be implemented independently of the CERCLA action to improve ground water quality entering the Site, the contingency measures described in this section may replace the selected remedy and ground water cleanup goals. These contingency measures will include refinement of ground water recovery and treatment system components of the remedial action, and continuation of institutional controls.

If it is determined, based on the successful implementation of the selected remedy, and contingency measures, that certain areas of the valley aquifer system cannot be expected to meet ARARs, notwithstanding whatever additional efforts which may be made, independently of this CERCLA action, to improve upgradient ground water quality entering the Site, then

a chemical specific ARAR will be waived for the cleanup of those portions of the valley aquifer system not meeting ARARs.

9. Regardless of the type of waiver evoked, ARAR waivers must be proposed on a contaminant by contaminant basis (for chemical specific ARARs) or on a requirement by requirement basis (for action-specific ARARs). For example, the MCLGs can be attained for some ground water contaminants throughout the plume. The ARARs for these ground water contaminants should not be waived. The FWQC for some of the surface water contaminants can be attained in the tributaries and river without mitigation of upstream sources; these should not be waived.

***U.S. EPA RESPONSE # 9:** Please see U.S. EPA RESPONSE 8 and the Ground Water and Surface Water ARAR discussions in Section 10.2 of the ROD.*

10. If ARARs for ground water and surface waters cannot be attained, the FS must establish cleanup levels which can be attained and which are protective of the human health and the environment. The FS states only that MCLs/ MCLGs for ground water and FWQC for surface water cannot be met; the document does not establish clean-up goals that will be attained under the various scenarios. Furthermore, the FS does not present an alternative that is protective of the aquatic environment. If FWQC cannot be met for the major contaminants, the SFCDR will remain toxic to several native species of fish, macroinvertebrates, and aquatic plants.

***U.S. EPA RESPONSE # 10:** U.S. EPA has determined that the federal water quality criteria for human health protection for the ingestion of organisms (fish) and the chronic aquatic wildlife water quality criteria (FWQC) under the Federal Clean Water act are applicable with regard to surface waters contributing to contamination onsite. With respect to the SFCDR, the RI demonstrates that the SFCDR water quality within the Site is significantly affected by loadings from sources upstream of the Site to a degree that even with total elimination of loadings from onsite sources, the FWQC for cadmium, lead, and zinc would still be exceeded (see, Section 5.2 of the Technical Memorandum: Post Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4). Because this ROD does not address remediation of SFCDR sources of contaminants (except for contribution from onsite sources), attainment of FWQC in the SFCDR is not an ARAR for this remedial action. See, the Ground Water and Surface Water ARARs discussion in Section 10-2 of the ROD.*

FINAL COMMENTS ON THE REMEDIAL INVESTIGATION

The RI document does not address most of the Tribe's prior comments on the draft RI nor does the document provide the detail and specific data necessary to analyze and evaluate remedial alternatives. This deficiency is exemplified by the fact that even though extensive studies of the ground and surface waters have been performed at the site, significant data gaps still remain and available data have been insufficiently and incompletely evaluated. As a result major uncertainties remain with regard to ground and surface water flow and loadings, and the correlation of these media with specific contaminant sources.

The RI does not adequately link ground water and surface water contamination with specific source areas. The failure to focus on specific contaminant sources does not allow an adequate analysis and evaluation of remedial alternatives for those sources. Focusing on the "source/pathway" approach to evaluation results in identification of significant pathways without identifying their specific sources. Therefore, the relative contributions of different contaminant sources have not been identified and evaluated. Consideration must be given to identifying the individual contaminant sources that are polluting surface and ground waters, rather than simply the extent and magnitude that these media have been contaminated.

U.S. EPA RESPONSE # 11: The comments received from the Coeur d'Alene Tribe and others were considered and evaluated throughout the RI/FS process. The Bunker Hill Administrative Record including the Remedial Investigation Report represents an extensive data collection and evaluation effort. Hundreds of samples were collected from the ground water, surface water, soil, and air media. Analytical data from these samples were evaluated using sophisticated numerical and analytical models. This data adequately characterize the sources and distributions of contaminants within the Site, and is sufficient to base decision on selection of alternatives.

Information relating to characterization of site hydrology is presented in a fragmented fashion. Nowhere in section 3.0 is the information integrated into a site wide overview of the hydrologic setting. The approach makes it difficult, if not impossible, for the reader to develop a conceptual framework for site hydrology in which to place information contained in subsequent sections. The presentation therefore precludes an understanding of contaminant movement throughout the site.

Surface water loading balances are based strictly on low flow conditions (discharge and concentration data). Baseline discharges during the RI monitoring period occurred for only six months of the year and accounted for only 20-25% of the total discharge for the year. Considering that high flow loadings are 5 to 6 times greater than low flow loadings for the SFCDR it is evident that the loading balances estimated for surface water are not representative of the actual impacts to surface water from onsite contaminant sources. Clearly, significant gaps exist with respect to surface water loadings at other than low flow conditions.

U.S. EPA RESPONSE # 12: Remedial Investigation (RI) loading estimates focused on low-flow conditions because of surface water concentrations, and thus impacts on aquatic biota, are demonstratively greater under such conditions. In addition, the RI loading balance focused on low-flow conditions because stream gain/loss is generally masked during high stream flows. However, estimates of high flow loadings are provided in the Task 2.0 Data Evaluation Report and summarized in Section 5.4.1.1. of the RI. Additional data is also being collected under the 1991 and 1992 Administrative Orders on Consent. This additional data will be considered during remedial design.

The RI document generalizes loading data by calculating and presenting CMLs instead of presenting data for individual metals. Presentation of loading information for individual metals in addition to CMLs (for both surface and ground water) would not overly complicate the document. Throughout the document, evaluations and discussions focus on arsenic, cadmium, lead and zinc, and consequently, other contaminants of concern identified in the SCR, including but not limited to antimony, cobalt, copper, mercury, silver, asbestos, and PCBs, are given minimal treatment.

U.S. EPA RESPONSE # 13: The Remedial Investigation (RI) document summarizes data gathered and analyzed during the RI process. It would be unmanageable to incorporate all of the data into the RI report. Therefore, much of it is incorporated by reference. Loading information for the individual contaminants arsenic, cadmium, cobalt, lead, and zinc for ground water and pertinent surface waters are provided in the Task 3.0 Final Hydrogeologic Assessment. This document also provides loading estimates for nitrate, phosphate, sulfate, potassium, and fluoride. Estimates of cadmium, lead, and zinc loadings throughout the Site surface water system are provided in the Task 2.0 Data Evaluation Report (arsenic and cobalt are not described in detail because these constituents were generally undetected in Site surface waters). Both the Task 2.0 and Task 3.0 documents are incorporated by reference in the RI Report. Other contaminants of concern identified in the Site Characterization Report (SCR), including antimony, copper, mercury, silver, asbestos, and PCBs were given minimal treatment because they were generally undetected in ground and surface water during the RI field investigations.

The ground water evaluation presented in the RI does not fully characterize ground water flow, contaminant loadings, or vertical and horizontal contaminant distributions. Because of a lack of well and borehole data in several areas within the site, critical data used in calculating ground water flows has been both estimated and extrapolated. Uncertainties associated with this data are probably large and therefore estimates of ground water flow also may have large associated errors. This is particularly significant for estimates of ground water flow entering and leaving the site.

U.S. EPA RESPONSE # 14: Ground water flow estimates from any site are typically subject to a fair degree of uncertainty. Such uncertainty stems from the following factors, which are associated with any hydrogeologic investigation:

- *Estimates of hydraulic conductivity that are subject to the physical vagaries of pumping tests (slight discharge variations, etc.) and assumptions of ideal aquifer characteristics (homogeneous, isotropic, etc.)*

- *Estimates of cross-sectional flow area that are based on scattered borehole data.*

However, additional ground water data is being collected under the 1991 and 1992 Administrative Orders on Consent. These additional data will be used to refine assumptions during remedial design activities.

Although the RI acknowledges additional wells are needed to fully characterize ground water flow leaving the site, it is also obvious that additional wells are required to characterize ground water flow entering the site at the upstream boundary. For example GR-44, which is located in the Milo Creek drainage some 600 feet upgradient from the SFCDR, has been used to characterize contaminants entering the site from upstream sources. However, the location indicates that contaminants as measured in the well more likely originate in Milo Gulch, rather than the SFCDR drainage. Consequently, contaminant loading estimates for ground water entering the site have been calculated using inappropriate concentration data and flow data with large uncertainties. Therefore, these loading estimates are highly suspect.

U.S. EPA RESPONSE # 15: We disagree that the location of monitoring well GR-44 provides data representative of ground water issuing from Milo Gulch. Our opinion is that water samples from GR-44 are representative of those in the main SFCDR valley, with some influence from Milo Gulch. With regard to the uncertainty of flow data at the east site boundary, we are unaware of ground water flow estimates from any site that are "certain". As noted above, some inaccuracy is inherent in the estimation of aquifer parameters and cross-sectional flow area.

The RI does not contain sufficient data to characterize ground water contamination in the lower zone and does not adequately evaluate contaminant sources for the lower zone. Of the approximately 30 well locations used to evaluate ground water quality in the RI, only six provide data for the lower zone. Cadmium and zinc concentrations for several lower zone wells show significant concentrations which in several cases equal or exceed corresponding concentrations in the upper zone. In addition, the connection between tributary ground water, which is highly contaminated in some tributaries, and the main valley ground water system is weak in the RI and is not adequately discussed.

U.S. EPA RESPONSE # 16: The sources of contamination in the lower zone have been adequately characterized. Enough data exist to advance to the evaluation of alternatives in the Feasibility Study.

COMMENTS ON THE FINAL FEASIBILITY STUDY FOR
THE BUNKER HILL SUPERFUND SITE

Executive Summary

ES-17: "...the cadmium DWS was exceeded near the east site boundary, indicating an impact from upgradient sources."

The cadmium DWS was exceeded at this well, which is downgradient of Milo Gulch. If only the cadmium ARAR is exceeded at the upgradient boundary, then waivers for the other contaminants are not justified by the upgradient source reasoning. Furthermore, given the fact that cadmium concentrations near the downgradient edge of the site "appear to be less than MCL/MCLGs due to dilution and attenuation", waivers of MCL/MCLGs for cadmium may not be justified in any case.

U.S. EPA RESPONSE # 17: Please see U.S. EPA RESPONSE 8 above.

ES-19: "The poorest ground water quality observed at the site occurred in upper Government Gulch south of the Zinc Plant and was probably associated with leaching of metals from a former materials storage area."

The Zinc Plant/Government Gulch area was eliminated from consideration as an acceptable disposal area in the RI Task 13.4 Waste Repository Selection Study "due to unfavorable hydrogeologic conditions". How will the problems relating to these unfavorable conditions and ground water contamination due to subsurface contaminant sources be overcome? The FS does not evaluate the hydrogeologic suitability of the Zinc Plant / Government Gulch area as a disposal area for the wastes and other contaminated materials.

U.S. EPA RESPONSE # 18: Upper Government Gulch was eliminated as a repository location because such a repository would require excavation of several tens of feet of material and this would intercept the water table. However, the selected alternative (Feasibility Study Alternative 3) provides for extensive ground water protection and mitigation measures in the upper Government Gulch area. Two ground water cutoff walls will be installed, one to divert relatively clean water around the area of contamination, and the other to collect contaminated ground water for treatment. The proposed Zinc Plant capped area is situated on the east side of Government Gulch, along the valley wall and <u>above</u> the valley floor. Substructures within the Zinc Plant are not known to become inundated with ground water and no further excavation is planned; therefore, this location appears to be hydrogeologically favorable. In addition, a leachate collection system will be installed downgradient of the Zinc Plant to collect any contaminated fluids emanating from the capped area. Detailed discussions of these issues are contained in the companion document "Technical Memorandum: Evaluation of Proposed Smelter Complex Closure Methods" which is referenced throughout the FS. It should also be noted that higher level materials in upper Government Gulch would be removed under the ROD.

ES-23: "Soils and Source Materials RAOs:...

2. Prevent the transport of materials that will result in the recontamination of residential soil above the mean community level....

6. Prevent the migration of the contaminants of concern from soil sources in concentrations that will result in exceedances of MCLs and/or maximum contaminant level goals (MCLGs) in ground water or Federal Water Quality Criteria (FWQC) in the SFCDR or its tributaries.

7. Prevent risks to environmental receptors from soil sources containing concentrations of contaminants of concern that constitute an environmental hazard or exceed acute or chronic toxicity levels.

8. Prevent direct release of sediments containing contaminants into surface waters of the SFCDR which would result in exceedances of FWQC or direct contact by humans in concentrations exceeding risk-based threshold levels."

The FS is not specific (by contaminant) about what is meant by mean community levels (RAO #2); concentrations of contaminants of concern (RAO #7) and threshold levels (RAO #8). Concentrations of soils and source materials will remain on the site and MCLs and FWQC will still be exceeded following any of the remedial alternatives.

ES-23 & 24 "Ground Water RAOs...

1. Prevent the transport of contaminants of concern to ground water from onsite sources that would result in exceedances of the MCLs and/or MCLGs.

2. Restore ground water resources where releases of contaminants from onsite sources have resulted in exceedances of MCLs and/or MCLGs for contaminants of concern.

3. Prevent the ingestion by humans of site ground water containing contaminants of concern exceeding MCLs and/or MCLGs.

4. Prevent the transport of contaminants of concern in onsite ground water to the SFCDR and its tributaries in concentrations that would result in exceedances of surface water ARARs."

MCLs and/or MCLGs will still be exceeded following any of the remedial alternatives.

ES-24: "Surface Water RAOs:...

1. Prevent the transport of contaminants of concern to the SFCDR or its tributaries from onsite sources that would result in exceedances of FWQC for the protection of human health and/or aquatic life.

2. Prevent the transport of sediments...in concentrations assessed to constitute an environmental hazard [by the site ecological assessment].

3. Restore surface water quality in the SFCDR.

4. Prevent the ingestion by humans of aquatic organisms from surface waters containing contaminants of concern exceeding the human health and/or aquatic life FWQC.

5. Prevent direct contact by humans from sediments...exceeding risk-based threshold levels.

6. Prevent risks to environmental receptors from sediment sources containing concentrations of contaminants of concern that constitute an environmental hazard or exceed acute or chronic toxicity levels."

The FS is not specific(by contaminant) about the assessed concentrations (RAO #2); threshold levels (RAO #5); and "concentrations ...that constitute and environmental hazard" (RAO #6). FWQC will still be exceeded following any of the remedial alternatives.

ES-25: "Development of Alternatives";

ES-38: "Threshold Criteria Analysis";

ES-40: "Alternatives 2, 3, and 4 were evaluated generally to be fully protective of human health although varying in approach and timing";

ES-45: "These elements also make the attainment of ARARs for the SFCDR and portions of the site ground water systems not feasible." ....Alternatives 2, 3, and 4 meet those chemical-specific ARARs identified for soils and source materials... "Alternatives 2, 3, and 4 would generally comply as practicable with identified chemical- and action-specific ARARs."; and,

ES-47: "Under none of the alternatives would all ARARs for ground water quality at all locations within the site be fully met....Under none of the alternatives would all ARARs for surface water quality in the SFCDR be met within the site boundaries..."

ES-48: "As the remedial alternatives were developed to meet the overarching protectiveness goals, specifically RAOs, most actions being considered under Alternatives 2, 3 and 4 comply with the action-specific ARARs identified."

Alternatives which meet the threshold criteria of compliance with ARARs and protection of human health and the environment should have been, but were not, developed in the Feasibility Study. None of the alternatives developed will result in compliance with the Drinking Water Standards or the Federal Water Quality Criteria. Action levels for soils and source materials do not meet RCRA requirements nor are they protective of environmental receptors. Risk-based threshold levels for soils, sediment, and water were not used to develop cleanup or remediation levels.

U.S. EPA RESPONSE # 19: U.S. EPA's protectiveness analysis does in fact evaluate the ability of each alternative to attain cleanup goals established during the initial stages of the Feasibility Study process (Remedial Action Objectives (RAOs)). Please refer to both the Human Health Risk Assessment (HHRA) and the Ecological Risk Assessment (ERA) for a comprehensive analysis of the impacts of site wide containment levels on both human health and ecological receptors.

All remedial actions developed were carefully screened and analyzed relative to the RAOs. Specifically, these analyses included an evaluation of baseline and post-remediation conditions and a comparison with the appropriate criteria. In fact, technical memoranda were developed to address these issues in greater detail, the expected performance of various remedial measures including a comprehensive analysis of the overall effectiveness of the final alternatives to improve water quality.

With respect to specific numerical values for ecological impacts the literature does not support the selection of an absolute number as a cleanup "goal". As stated in the ERA, the literature does, however, support estimating contaminant ranges in soils which may have a potential impact on sensitive ecological receptors. These numbers are included in the ERA and summarized in Section 6 of the ROD. Two additional considerations are worthy of note; first, the numbers presented in the ERA are derived from the literature, not from an analysis of actual populations found onsite (the ERA discusses data limitations in more detail); second, due to the widespread habitat destruction onsite much of the potential impacts to ecological receptors is not occurring at present.

The statement that safe "threshold" levels for contaminants, other than lead, were not determined is incorrect. Both the HHRA and ERA evaluated multiple contaminants. In the case of the HHRA it was determined that lead was the contaminant most likely to cause impacts to sensitive human populations, and that control of lead sources would also serve to control the other identified contaminants of concern. The HHRA discusses potential health impacts of these other contaminants. As noted previously the ERA does provide "threshold" levels for potential impacts to terrestrial and aquatic receptors. Soil levels are provided in Table 6-4. For aquatic protection FWQC are considered to be safe "threshold" levels.

Both the RI/FS and ROD discuss the ability of each alternative to attain safe "threshold" levels for contaminants of concern. It is noted that in order for a remedy to provide adequate levels of protectiveness safe "threshold" levels need not be met at all areas of the Site. U.S.

EPA policy gives the agency the flexibility to assure overall protectiveness through a variety of mechanisms, including both engineering and institutional controls.

Admittedly, institutional controls are more effective in controlling human exposure to environmental contaminants than in controlling exposure of ecological receptors. However, many potential exposures of ecological receptors are not currently occurring due to lack of habitat. It is believed that as habitat is established across broad areas of the hillsides and Smelterville flats (much of which has been regraded, or will be capped as part of the selected remedy). Actual impact will be limited. Nonetheless, the preferred alternative calls for biomonitoring of sensitive species to verify that projection. The reader is also referred to the considerable success of the Hillsides Revegetation & Stabilization Program in re-introducing vegetative cover in some of the most severely impacted soils onsite.

ES-40: "Table 2 summarizes the relative performance of the four alternatives as expressed in the detailed analysis. A summary of findings is provided adjacent to a "yes" or "no" assessment pertaining to attainment of threshold criteria."

This table incorrectly represents Alternatives 2, 3, and 4 as Alternatives that protect human health and the environment and comply with ARARs.

U.S. EPA RESPONSE # 20: U.S. EPA disagrees with this comment based on the discussions in Sections 8 and 9 in the Feasibility Study.

ES-40: "...the two alternatives would attain (where possible through site measures) the RAOs for surface and ground water quality while maximizing restorative benefits.... Overall, both alternatives address, to a very high degree, those ecological risks identified within the site. Both Alternatives 3 and 4 are thought to be fully protective of human health and the environment through large improvements in all site conditions."

and

ES-47: Contaminant loadings attributable to upstream sources and to dispersed and largely inaccessible jig tailings throughout the river valley "...cannot practicably be controlled or treated at the site, thus precluding development of alternatives involving only onsite action to meet the MCL/MCLG ARARs for ground water in all areas of the site aquifer system". "Improvements in surface water and ground water entering the site, coupled with the actions of Alternative 3 or 4, may allow for attainment of MCL/MCLGs in portions of the site aquifer which currently exceed those criteria." Contaminant loadings attributable to upstream sources and to disposed tailings throughout the river valley cannot practicably be controlled at the site, thus precluding the development of alternatives involving only onsite actions to attain all of the FWQC." "Alternatives 2, 3, and 4 would, however, meet the FWQC in onsite tributaries for base flow conditions."

and

ES-48: "Alternative 3...is expected to be more effective in the long-term than Alternative 4..." "The repositories planned under Alternatives 2 and 4 would be designed to meet the potentially relevant and appropriate aspects of repository design requirements under RCRA." "The emphasis on treatment of principal threat materials under Alternative 3, coupled with the innovative wetlands treatment systems, is expected to be more effective in the long-term than Alternative 4."

We disagree with these and other similar statements made throughout the FS and do not believe that they are supported by an objective analysis.

U.S. EPA RESPONSE # 21: U.S. EPA strongly disagrees with the comment.

ES-49: "Although Alternatives 3 and 4 would achieve a high contaminant loading reduction for ground and surface water, all three non-baseline alternatives require institutional controls against water use."

Unfortunately, the remedial alternatives evaluated will all result in restricted use of the water resources.

U.S. EPA RESPONSE # 22: U.S. EPA agrees that there will continue to be some restrictions on the use of water resources, primarily ground water within the 21 square mile Site. The current water supply is not from the site ground water, but rather is from surface water supply not impacted by site wide contamination. An additional source of water is being developed at this time. As discussed previously, restoration of onsite water resources is dependent upon control of upgradient sources of contamination. The Coeur d'Alene Basin Restoration Project is expected to address these upgradient sources.

ES-50: "...high-volume/low-toxicity materials comprise a majority of the source materials identified for the site,...Alternative 4 relies on removal and containment".

The FS does not define what is meant by "high-volume/low-toxicity materials".

U.S. EPA RESPONSE # 23: The term "high-volume/low-toxicity" throughout the Feasibility Study is used in the same context as in the Bevill Amendment.

1-3: "Development of site wide medium-specific RAOs will facilitate evaluating achievement of remediation goals, as may be refined by the results of the pending Human Health Risk Assessment and Ecological Risk Assessment, which are structured to address risk concerns site wide."

The FS fails to specify the remediation goals (see discussion in cover letter) and how the results of the risk assessments were used to establish threshold levels and cleanup goals.

U.S. EPA RESPONSE # 24: With respect to specific numeric values for ecological impacts the literature does not support the selection of an absolute number as a cleanup "goal". As stated in the Ecological Risk Assessment (ERA) the literature does, however, support estimating contaminant ranges in soils which may have a potential impact on sensitive ecological receptors. These numbers are included in the ERA and summarized in Section 6 of the ROD. Two additional considerations are worthy of note; first, the numbers presented in the ERA are derived from the literature, not from an analysis of actual populations found onsite (the ERA discusses data limitations in more detail); second, due to the widespread onsite habitat destruction, potential impacts to ecological receptors are not occurring at a significant rate.

1-7: "Conclusions from the Human Health Risk Assessment for the non-populated areas of the site and the site Ecological Risk Assessment are used to evaluate the protectiveness of the preliminary remediation goals reflected in the RAOs."

How was protectiveness evaluated? What, specifically, are the preliminary remediation goals referred to? How were the conclusions from the risk assessments used to make these evaluations?

EPA RESPONSE # 25: Please see U.S. EPA RESPONSE 24 above.

2-29: "RAOs for surface water:

1. Prevent the transport of contaminants of concern to the SFCDR or its tributaries from onsite sources that would result in exceedances of FWQC for the protection of human health and/or aquatic life.

2. Prevent the transport of sediments containing contaminants of concern to the SFCDR or its tributaries from onsite sources in concentrations assessed to constitute an environmental hazard [by the site ecological assessment].

3. Restore surface water quality in the SFCDR or its tributaries where releases of contaminants from onsite sources have resulted in exceedances of FWQC for the protection of human health and/or aquatic life for contaminants of concern....

5. Prevent direct contract by humans from sediments within the surface waters containing contaminants of concern exceeding risk-based threshold levels.

6. Prevent risks to environmental receptors from sediment sources containing concentrations of contaminants of concern that constitute and environmental hazard or exceed acute or chronic toxicity levels."

The FS does not provide adequate detail in the RAOs: What concentrations in sediment have been assessed to constitute an environmental hazard (RAO#2)? What specifically are the non-populated area risk-based threshold levels for human and ecological health referred to in RAO#5? What are the concentrations of contaminants that constitute an environmental hazard (RAO#6)?

U.S. EPA RESPONSE # 26: Please see U.S. EPA RESPONSE 19 above.

3-29: "Assuming an average thickness of 5 feet, the volume of accessible jig tailings at the site may be on the order of 8,700,000 cy; ..."

What RI or other data was used to develop the thickness estimate and the map of the jig tailings? The FS does not cite or summarize the supporting data .

U.S. EPA RESPONSE # 27: The jig tailings thickness map is based on borehole and test pit information collected during the Remedial Investigation (RI), as well as visual observations. This information is not cited in the Feasibility Study (FS) because it was developed early in the RI process, and is summarized by the thickness map. For additional detail, please see the response to Comment No. 3 on Volume II of the FS and the response to Comment No. 2 (Individual Comments/Responses: Section 2), of the January 22, 1990, letter from John Meyer to T. Barry Tierney. This comment, and its response, are included on page 12 of the addendum to the "Protocol for Bunker Hill RI/FS Ground-Water Models".

4-19: Table 4.2-3 INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SITE SURFACE WATER - Source Controls -> Removal -> "Excavation and/or Disposal of Selected Source Materials Onsite and/or Offsite." (page 3 of 4)

Please note that these options for site surface water are applicable to upstream source areas and other offsite contaminant source materials in the watershed.

U.S. EPA RESPONSE # 28: Comment noted. Upstream sources and other offsite sources are not addressed under this action.

4-20: Treatment-> Treatment Plant-> Conventional Metals Precipitation; Ion Exchange (page 4 of 4).

Please note that these options are also applicable to SFCDR water treatment.

U.S. EPA RESPONSE # 29: As mentioned in the ROD, the SFCDR is not being addressed by this action. In any event, conventional treatment of flow rates seasonally varying between 70 cfs and 1500 cfs, such as at the downstream boundary of the Site, is technically infeasible.

5-39: "Also, the RI revealed that most of the mine dumps are stable and resistant to erosion, although a few exceptions were noted."

If, as stated here, there are mine dumps which aren't stable or erosion resistant, then excavation and removal should have been retained as a technology for consideration.

U.S. EPA RESPONSE # 30: Complete removal of <u>all</u> mine dumps within the Site was screened out. However, mine dumps which have been identified as being unstable or potentially unstable are being addressed under the terms of both the Hillsides Administrative Order on Consent and the 1991 Smelter Complex Unilateral Administrative Order.

5-42: "The options listed below will not be used in the development of remedial alternatives at the Subarea level....

- Removal of all accessible jig tailing for offsite treatment and/or disposal..."

It seems that facilities for treatment and/or disposal of wastes was not thoroughly researched as part of the FS. The FS should include removal of all accessible jig tailings for offsite treatment and/or disposal as a technology for consideration.

U.S. EPA RESPONSE # 31: No treatment was found for jig tailings that would reduce mobility, toxicity, or volume. Conventional beneficiation techniques will not recover sufficient metals to reduce either mobility or toxicity since the jig tailings are a product of these techniques. No other offsite treatment was found to provide any environmental benefits.

5-47: "Since the volume of jig tailings in this area is large, implementation of this option would be limited by the availability of a suitable disposal facility within a reasonable haul distance with the capacity to handle the potential quantity of materials."

What facilities are available? Have offsite disposal area alternatives been seriously considered?

U.S. EPA RESPONSE # 32: Offsite disposal has been seriously considered, but was screened out because no suitable offsite disposal facilities were identified and offsite disposal offered no additional benefits over onsite disposal.

5-51: "The options listed below will not be used in the development of remedial alternatives at the subarea level....

* Removal of material accumulations for offsite treatment/disposal...."

Since removal and treatment of the highly-concentrated "material accumulations" within the CIA would substantially reduce the toxicity of the CIA materials, offsite treatment/disposal options should have been considered also.

U.S. EPA RESPONSE # 33: As shown on Table 5.2-6 in the Feasibility Study, removal of material accumulations from the CIA for disposal and/or treatment has been retained as a viable remedy. However, disposal will occur onsite, under the Lead Smelter cap. Thus, the toxicity of the CIA materials will be "substantially reduced".

5-102: Non-populated Areas ROW - The options "listed below will not be used in the development of remedial alternatives at the subarea level.

* Removal of surface soils for onsite or offsite disposal." and 5-106: "...option is currently being employed for the remediation of residential yards, but its applicability for the non-populated areas ROW is questionable due to the problems associated with excavation and removal of soils from around established roads, railroads, and utility easements....The implementation of this option is technically infeasible...The cost of implementing this options is high..."

Removal of contaminated materials from the non-populated area ROW's should have been evaluated as an alternative. It is technically feasible to do removal in the populated areas and is not cost-prohibitive.

U.S. EPA RESPONSE # 34: The removal of <u>all</u> ROWs was justifiably screened out in the Feasibility Study (FS). However, as mentioned on page 5-107 of the FS, site specific removals in certain locations in ROWs was refrained.

Volume II, Feasibility Study

6-5: Contaminated soils

The FS fails to specify what soil contaminant levels were used to determine which soils are "contaminated" and which were not.

U.S. EPA RESPONSE # 35: Please see U.S. EPA RESPONSE 19 above.

6-2: "In addition, the presence of materials presenting acute toxicity hazards or imminent risk (principal threat materials) was also factored into the alternative development and screening."

The FS fails to explain how the presence of materials presenting toxicity hazards to environmental receptors was factored into the alternative development.

U.S. EPA RESPONSE # 36: Monitoring of the remedial action is a component of the ROD. As stated in the Ecological Risk Assessment, the selection of an absolute number as a cleanup goal with regards to ecological receptors is not possible. For this reason the evaluation of Principal Threat Materials was conducted with regards to short term human exposure. Please see U.S. EPA RESPONSE 19 above for further discussion.

6-7: "For subsurfaces borehole and backhoe sites, maximum measured concentrations are generally located within 1 to 5 feet of the surface..." "In particular, source control may be most appropriate for inaccessible areas (e.g., steep hillsides), areas of undisturbed soils, and large volumes of relatively low level contamination (i.e., the CIA tailings),..."

The FS does not discuss how subsurface contaminants will be remediated, including those that have been discovered at depths greater than 5 feet.

U.S. EPA RESPONSE # 37: As stated in the ROD, remedial design will include a process for determining the extent of excavation in areas impacted by material accumulations. Smelter Complex areas with soil contamination at depths of up to five feet are relatively small. Such areas will be remediated by excavation, with the excavated soils being used as grading fill beneath the Lead Smelter and/or Zinc Plant caps.

6-16: Constructed Wetlands Treatment System

The FS does not determine the effluent limits the discharge will reasonably be able to meet.

U.S. EPA RESPONSE # 38: The ROD states that this system must meet a minimum of 90% removal efficiency and will meet water quality based effluent limits prior to discharge to the South Fork Coeur d'Alene River.

6-21: "RI shows that an average cadmium concentration of 0.344 mg/l was measured in three batch adsorption tests involving rain water and jig tailings samples....Thus, the continued presence of uncontrolled jig tailings combined with uncontrolled upgradient loadings likely would result in exceedances of MCLs (primarily in the upper zone)."

The RI batch tests were inconclusive regarding metals releases. The FS does not adequately address what can be done to control or to treat the contaminants in the upper and lower zone. If onsite sources were removed, MCLs may be met for onsite ground waters.

U.S. EPA RESPONSE # 39: The Remedial Investigation (RI) batch tests, which were conducted using actual samples of jig tailings and rain water collected from the Site, provide useful results, though these results are naturally subject to some uncertainty. Based on the data generated during the RI, removal of all accessible jig tailings could result in failure to meet MCLs because of the continued presence of jig tailings at inaccessible locations.

As determined in the Residential Soils ROD, there are large areas of jig tailings which cannot be reasonably removed.

6-22: Constructed Wetland Treatment Systems for Remediation of Metals in Site Drainage - "additional data may need to be compiled during the Remedial Design phase to quantify precisely the load reduction associated with this option".

The removal rates of 90% used in the FS and water quality projections are overly optimistic. The analyses should have been performed using a range of, or a more realistic estimates for removal efficiency. Note that efficiency of removals at the Morning Mine ranged from 37 to 76% in 1990.

U.S. EPA RESPONSE # 40: Please see U.S. EPA RESPONSE 38 above for wetland treatment system effluent limits. The ROD further states that if these effluent limits are not met, pretreatment of influent containment streams or modifications to the treatment systems will be required.

6-39: Alternative C - "However, available information indicates that effluent from the wetland would meet surface water quality aquatic standards (Appendix H)."

There is not information available or presented to support the contention that the effluent discharged from the wetland would meet aquatic life criteria.

U.S. EPA RESPONSE # 41: Please see U.S. EPA RESPONSE 38 above.

6-51: Table 6.5-1 - Soils and Source Materials: Alternative B = same as Alternative A.

As demonstrated by this Table, a range of Alternatives for the remediating the hillsides have not been evaluated.

U.S. EPA RESPONSE # 42: The work plans that had been developed for the Hillsides Administrative Order on Consent had already examined a range of alternative response actions for these areas of the Site. Because this work has already been underway for two years it makes no sense to further evaluate a range of options for the hillsides. The work plans for the hillsides were jointly developed by representatives of various federal and state agencies, and the PRP group.

6-80: "However, neither suitable milling or refining facilities are currently available to handle Smelterville Flats materials nor is a suitable disposal site available for subsequently produced materials."

The FS does not identify the site(s) that have been located for offsite waste disposal and why they are unsuitable. Information is not provided as to whether the sites are developed or undeveloped.

U.S. EPA RESPONSE # 43: No offsite disposal sites were located.

7-30: "The focus of this aspect of site wide Alternatives 3 is to reprocess/recycle"

The focus of Alternative 3 is reprocess/recycle. Therefore, the FS should have considered reprocessing, treatment or recycling of all hazardous material in the smelter complex (in addition to the CDFDP and acid tank sludges).

U.S. EPA RESPONSE # 44: The Record of Decision does consider reprocess or recycling of <u>all</u> materials in the Smelter Complex. In addition all Principal Threat materials that are not reprocessed or recycled will be treated prior to disposal in the Smelter Complex.

8-22: "...water quality in the SFCDR within the site would continue to exceed FWQC for human and aquatic effects principally due to contaminant loadings from uncontrolled sources upstream of the site, which are outside the purview of this RI/FS. Furthermore, no practicable technology is available to treat the SFCDR itself."

We believe that the upgradient sources can and should be mitigated and that there are treatment technologies which are available to reduce the concentration of contaminants in the SFCDR.

U.S. EPA RESPONSE # 45: U.S. EPA agrees that upgradient sources should be mitigated and looks forward to the Tribe's active participation in the Coeur d'Alene Basin Restoration Project to accomplish this.

As previously noted, conventional treatment for the SFCDR is infeasible due to the large and widely varying flow rates.

9-9: "Both alternatives 3 and 4 are thought to be fully protective of human health and the environment."

Referring in general to section 9-2:

Alternative 2 does not meet the threshold criterion of protection of human health and the environment. Alternative 3 has not been shown to be protective. Alternative 4 has substantial benefits relating to restoration, improvements to the site environment and ecological conditions. The FS failed to provide an objective analysis of the alternatives and should have considered source control and/or treatment to address the upgradient sources contaminants and loadings.

U.S. EPA RESPONSE # 46: U.S. EPA disagrees with this comment, and believes that the three alternatives are, in fact, protective of human health and the environment. As stated repeatedly, upgradient sources of contamination will be addressed in the Coeur d'Alene Basin Restoration Project.

Section 8, Feasibility Study

Most of the major comments on Section 8.1.1 and 8.1.2 are included in the Comments Regarding the Listing and Analysis of ARARs and TBCs (attached). The following are more specific to sections of the text in Section 8 and are arranged according to subject matter or environmental media. Since many of the comments are pertinent to assumptions and statements made repeatedly in Section 8, arrangement of the comments by pages in the FS was not practicable.

1. Section 8.2 The FS assumes 100% effectiveness in revegetation efforts in estimating effectiveness of alternatives and in describing baseline conditions. Given the difficulties encountered during the recent vegetation test plots, this assumption should not be made. A more realistic percent effectiveness should have been used throughout the analysis of alternatives.

U.S. EPA RESPONSE # 47: The ROD requires 85% ground cover with approximately 8 - 12 years. Regarding the comment on test plots, U.S. EPA would like to note the success of the revegetation efforts in the Silver Bowl area.

2. The FS (Table 8.2-0) failed to provide information regarding the approximate areas and volumes of waste materials not addressed in the alternative remedial actions. For example, how many acres of jig tailings are to be left in place in Smelterville Flats under the various scenarios? This information is important in determining the residual risk under each of the four alternative scenarios.

U.S. EPA RESPONSE # 48: Sufficient information is provided in the Feasibility Study to estimate remaining areas and volumes of jig tailings for the various scenarios. For example, the total estimated area of jig tailings within the Site is 1,080 acres (FS, p. 3-29), and the total area of accessible jig tailings on Smelterville Flats is 499 acres (FS, Appendix B). Areas to be removed under the various alternatives are provided on Table 8.2-0 in the FS. The desired estimates of remaining jig tailings can be derived by subtraction.

3. Bioaccumulation

The FS fails to address bioaccumulation as a significant pathway. For example, the document suggests that the soil RAO addressing risks to environmental receptors from hillside soils would be achieved under Alternative 2, 3, and 4. However, the document did not consider nor discuss the potential risks associated with bioaccumulation of contaminants. This is a consideration when contaminated soils are re-vegetated, thus creating increased food supply and habitat for wildlife. The FS also fails to address the potential bioaccumulation problem associated with the wetland treatment system proposed under Alternative 3.

U.S. EPA RESPONSE # 49: Monitoring of the remedial actions is a component of the ROD. This includes biological monitoring. If bioaccumulation is determined to present a risk during this monitoring, steps will be taken to eliminate this risk.

4. RAOs Addressing Risks to Environmental Receptors

a. The FS states that the RAOs for soils/source materials will be substantially achieved under several of the alternative remedial actions. However, the RAO that addresses protection of environment receptors from soil/source materials contaminants is not adequately achieved, as the threshold levels to small mammals and the phytotoxic levels for native vegetation (as identified in the ERA) are exceeded throughout the hillside areas under all alternatives. No solution to these environmental risks, other than natural attenuation of toxic levels in the soils, is suggested in the FS.

U.S. EPA RESPONSE # 50: The Ecological Risk Assessment listed these areas as areas of potential impact. Because of the widespread habitat destruction onsite, much of the potential impacts to ecological receptors is not occurring at present. Should monitoring show that the remedial actions are not working other measures will have to be taken. The work under the Hillsides Consent Order is expected to accelerate the natural attenuation process. Please refer to U.S. EPA RESPONSE 19 above.

b. At one point (page 8-17, paragraph 2) the document states that some risk to certain of these (environmental) receptors would remain. However, the risk that remain are not specified or quantified, nor are the environmental receptors specified.

U.S. EPA RESPONSE # 51: Please see U.S. EPA RESPONSE 19 above concerning absolute numbers for clean up goals for ecological receptors.

c. The surface water RAOs #3 (Restore surface water quality in the SFCDR...) and #6 (Prevent risks ...from sediment sources....) will not be met under any of the alternative remedial actions. Jig tailings which contribute heavy metal contamination to the SFCDR and contaminated sediments in the bed and banks of the river will not be adequately remediated, nor will the FWQC be met under any of the proposed alternatives sufficiently to meet these objectives.

Please see the following pages to which these comments pertain: Page 8-6 ; Page 8-12, Paragraph 1; Page 8-17, Paragraphs 2 and 3; Page 8-22, paragraph 3; Page 8-24, Paragraph 4; Page 8-31, Paragraph 3.

U.S. EPA RESPONSE # 52: The jig tailings within the Site will be adequately remediated. All exposed tailings along the banks of the South Fork Coeur d'Alene River (SFCDR) within the Site will be removed or stabilized to prevent erosion. Please see Section 9.2.2 of the ROD. The water quality in the SFCDR is also affected by upgradient sources. These will be addressed in the Coeur d'Alene Basin Restoration Project.

5. Air

a. The FS does not address air-borne contaminants of concern other than lead. There are no NAAQSs for these contaminants; therefore, TBCs or site specific levels developed through the risk assessments must be used in determining the protectiveness and effectiveness of the various alternatives discussed. The ability of each of the proposed alternatives to eliminate the risk posed by all airborne contaminants of concern should have been discussed (see Page 8-10, paragraph 2; Page 8-15, paragraph 5; Page 8-46, paragraph 4; Page 8-51, paragraph 3; Page 8-59, paragraph 2; Page 8-66, paragraph 2).

U.S. EPA RESPONSE # 53: The Human Health Risk Assessment has determined that by controlling lead the other contaminants are also controlled.

b. On Page 8-18, Paragraph 2, the FS states that actions under alternative 3 are expected to reduce fugitive air emissions which may exceed risk-based levels for other metals in the air. These risk-based levels for the air contaminants of concern are not identified nor quantified.

U.S. EPA RESPONSE # 54: Please see U.S. EPA RESPONSE 53.

c. The FS also fails to discuss and address air contaminant levels associated with high wind events, during which air-borne contaminants may reach levels which pose a risk to human health (see Page 8-10, paragraph 2; Page 8-26, paragraph 4; Page 8-46, paragraph 2).

U.S. EPA RESPONSE # 55: The remedial actions selected (containment, removal, and treatment) will isolate contaminated material from high winds; therefore, contaminant levels will not reach a point where they pose a risk to human health. It should be noted that the dust controls conducted under Administrative Orders in 1991 and 1992 have already reduced the major sources of fugitive dust.

d. On page 8-10, paragraph 2, the FS refers to a "reasonable time" for attaining and maintaining site wide blood-level goal. However, no information is provided to indicate what is meant by the authors by the term "reasonable time".

U.S. EPA RESPONSE # 56: U.S. EPA anticipates that the "reasonable time" will be approximately five years after completion of all remedial action.

6. Ground Water

a. The FS provides estimates of reductions in CMC in upper and lower ground water zones under the various alternatives (42% and 63%, respectively for Alternative 2; 53% and 65%, respectively for Alternative 3; and 75% and 65%, respectively for Alternative 4). The FS later states (page 8-39, paragraph 1): "...RI data for the lower zone of the valley ground water system are sparse and projections of its post-remediation water quality within the site could not be made...Whether these concentrations will be reduced to the point of ARAR attainment under any of the alternatives cannot currently be ascertained". The lack of reliable RI ground water data (especially for the lower zone) and the problems associated with analysis of existing ground water data should preclude the authors from making any such definite statements with respect to possible improvements in ground water quality. Additional ground water data and analysis is needed in order to meet the objectives of the RI/FS. (See pages Page 8-12. Paragraph 2; Page 8-20, paragraph 1; Page 8-28, paragraph 3; Page 8-39, paragraph 1).

U.S. EPA RESPONSE # 57: The noted estimates of percent Combined Metals Concentration reductions are applicable to a single point within the Site, namely the area just upstream of the South Fork Coeur d'Alene River confluence with Pine Creek (see the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4). The available data for this area, for both the upper and lower zones, are considered to be relatively good (see data for monitoring wells GR-26U and GR-26L). The referenced percent reductions are not meant to apply to the upper and lower zones in their entireties.

b. The feasibility of removing jig tailings which result in exceedances of MCLs/MCLGs is not adequately considered and discussed in the FS. The FS states that jig tailings underlie private or public properties, and thus cannot be removed without disrupting the community. However, there are large volumes of jig tailings along the river bed and banks and in areas which are not developed. These jig tailings, which can be removed without severely disrupting the community, are not addressed in the FS. The actual acres/volume of unaccessible; (e.g. underneath buildings), versus accessible tailings and the contaminant loadings which can be attributed to these tailings should have been, but were not, provided in the FS (see Page 8-12, paragraph 2; Page 8-20, paragraph 2; Page 8-28, Paragraph 4; Page 8-29, paragraph 1; Page 8-51, paragraph 1; Page 8-66, paragraph 1).

U.S. EPA RESPONSE # 58: Identifiable areas of jig tailings deposition are not present along the South Fork Coeur d'Alene River (SFCDR) within Kellogg due to river channelization. However, erodible jig tailings are present along the SFCDR near the north side of the CIA and throughout Smelterville Flats. Removal or stabilization of these areas is addressed by Feasibility Study (FS) Alternatives 3 and 4. Under Alternative 3, construction of the floodway would involve removal of jig tailings from the SFCDR channel (see Section 6.6.1.3 of the FS). Under Alternative 4, all accessible jig tailings would be removed from Smelterville Flats and the area north of the CIA (see Section 6.6.1.5 of the FS). As previously noted, sufficient information is provided in the FS for the calculation of areas or volumes of jig tailings remaining onsite under each of the prescribed alternatives.

c. Table 8.2-3 (Page 8-39, paragraph 2) does not support the statement that ground water quality is materially influenced by loading from sources upgradient of the site and from interaction with jig tailings dispersed throughout the site. The Table simply shows that the ground water throughout the site is contaminated and that the MCL for Cd cannot be attained under any of the four alternatives proposed.

U.S. EPA RESPONSE # 59: The pre-remediation concentrations of cadmium and zinc in monitoring well GR-44 shows the influence of waters entering the Site from upstream areas (Table 8.2-3 of the FS). The impact of jig tailings is implicit on this table through the non-attainment of the cadmium MCL; under Alternatives 3 and 4, the diffuse and widespread jig tailings are the only major contaminant source that remain largely unmitigated.

d. Page 8-36 through 8-40. This section does not accurately reflect the fact that ground water at the site is classified as a potential drinking water source and should be remediated to a level that allows this use. The authors appear to skim over this fact in the effort to justify an ARAR waiver based on "technical impracticability".

U.S. EPA RESPONSE # 60: Please see U.S. EPA RESPONSES 8 and 22 above.

7. Surface Water

a. The FS does not consider the ability of the various proposed alternative remedial actions to attain FWQC for surface water flows which are greater than "baseline flows" in the SFCDR and tributaries. (page 8-13, paragraph 4).

U.S. EPA RESPONSE # 61: The Remedial Investigation demonstrates that contaminant concentrations within the South Fork Coeur d'Alene River, and thus impacts on aquatic biota, are highest during low flow conditions. Additionally, low flow conditions prevail throughout the majority of a given year. Therefore, Feasibility Study alternative development focused on these critical conditions.

b. The FS claims that the contaminants of concern will continue to exceed FWQC due to upstream sources and widely dispersed jig tailings. However, the contaminants of concern which will continue to be problematic after completion of remedial activities, and the degree to which the FWQC will continue to be exceeded is not specified (see Page 8-14, Paragraph 2). Information on residual contamination at the completion of remedial activities is essential to the analysis of the effectiveness of the alternative remedies and the impacts of the remedial action alternatives on the Lower Coeur d'Alene River Basin (see Page 8-14, Paragraph 2 and page 8-22, Paragraph 2).

U.S. EPA RESPONSE # 62: Information on residual risk to the ground and surface water systems is provided in the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4. This document is referenced repeatedly throughout the FS.

c. The FS states that it is estimated that the CMCs could be reduced in the SFCDR by 35% in the vicinity of the Pinehurst Narrows. It is unclear what comparison is being made: Is it 35% of the CMCs at the upstream boundary? Is it 35% of the CMCs at Pinehurst Narrows under a no-action alternative. The FS failed to clarify this statement. (See page 8-21, paragraph 2).

U.S. EPA RESPONSE # 63: The referenced percent reduction is relative to concentrations measured in the Pinehurst Narrows area under pre-remediation conditions. This is evident

upon review of the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4, which is referenced in the noted paragraph.

d. On page 8-43 (Table), the FWQC for copper, cadmium, lead, silver, and zinc should be calculated according the hardness level (CaC03 mg/L) of the river water at the specific sampling points reported.

U.S. EPA RESPONSE # 64: Comment noted. However, the data ranges and generic Federal Water Quality Criteria (FWQC) are provided only for comparison purposes. In addition, the hardness value used to derive the FWQC (100 mg/l as $CaCO_3$) is a typical value for the South Fork Coeur d'Alene River.

8. Short-Term Risks

The analysis of short term risks under the Alternatives 3 and 4 are not handled equally. With respect to Alternative 3, the FS states that short-term habitat disruption would be offset by the long term benefits of improved water quality and structural/physical habitat. With respect to Alternative 4, the FS simply states that some increase in short term habitat disruption will occur during implementation. No mention is made of the offset by long term benefits (see page 8-23, paragraph 2 and page 8-30, paragraph 4).

U.S. EPA RESPONSE # 65: The long term benefits for Alternative 4 are deemed only slightly greater than Alternative 3; however, the short term impacts are significantly greater than Alternative 3 because of the extensive excavation in Smelterville Flats.

9. Cross-media impact

The FS fails to acknowledge the cross-media impact associated with movement of hazardous and contaminated substances in mine operating areas under Alternatives 3 and 4.

U.S. EPA RESPONSE # 66: The ROD addresses cross-media impacts for all remedial actions during implementation. These include both dust and runoff control.

COMMENTS ON THE CONSTRUCTED WETLAND TREATMENT SYSTEMS

The proposed constructed wetlands treatment system would rely on a continuously saturated, subsurface, anaerobic system with no free-standing water, adequate degradable organic matter, and a surplus of sulfate so that dissimulatory sulfate reduction would result in the precipitation of contaminant metals as metal sulfides. Projected performance is at least 90% metals retention. One part of this system will treat water from Government Gulch, Bunker Creek, and the CIA Seeps. Another part of the system will treat ground water.

Flow variations in the SFCDR are significant. The lowest flow recorded was 30 cfs on January 11, 1975. The highest recorded flow at Smelterville was 11,500 cfs on January 16, 1974, just a year before the lowest flow. The high flows in the SFCDR scour the river bed and bank, picking up contaminated soils and sediments, carrying them downstream.

Transport of contaminated soils from the hillsides by runoff is significant. Lead concentrations range from 1,000 to 13,700 ppm, and cadmium levels from 50 to more than 245 ppm in the hillside soils. The lack of terrestrial vegetation (due to soil conditions) leads to reduced evapotranspiration and water holding capacity, causing much higher runoff than a naturally vegetated area would have.

Zinc, lead, and cadmium are the primary aquatic contaminants of concern at this site (USEPA Region X 1991). The increase in the mass metals loadings to the South Fork as it travels through the Bunker Hill Site have been estimated as shown in the table below.

Load Increase Across the Bunker Hill Site

	Load Increase (lbs/day)			Percent Increase		
	Low Flow (lbs/d)	High Flow (lbs/d)	Runoff (lbs/d)	Low Flow %	High Flow %	Runoff %
Cd	4.5	22.1	33.2	82	132	253
Pb	8.2	501.5	332	84	702	134
Zn	738	2607	2937	106	110	138

Source: adapted from Table 5-1, USEPA Region X 1991

High and runoff event flows carry the largest loadings of metals. Due to the higher loading during high flow events, the problems of lack of capture by the wetlands treatment system are exacerbated by the diversion of high flow. Diverting sheet flow and site runoff and storm surges greater than the 10 year flood levels ignores the non-point character of the metal loadings from this site. The FS assumption that vegetation efforts on the site will be 100% effective and thus, reduce onsite loadings from the tributaries, is unsupported. Vegetation efforts on the site will depend on plant adaptability, and the success of vegetation test plots has not been demonstrated. The soils are so contaminated at this site that plants may not take root. Early revegetation efforts had mixed success. Revegetation reported in the Interim Site Characterization includes study plots on the hillsides, the valley floor, and on the tailings ponds, which have had varying levels of success. Shrub species in these plots had poor survival rates. Low fertility caused problems with valley floor plots. Mulch addition and legume plantings yielded spotty areas of reclamation. Tree plantings on the hillsides using containerized seedlings had the greatest success. Unfortunately, trees alone probably have the least impact on surface runoff.

U.S. EPA RESPONSE # 67: It is unclear as to where within the Feasibility Study the assumption of "100 percent revegetation effectiveness" is provided; even moderate levels of revegetation success will provide reductions in sediment loadings from the hillsides. Revegetation is only one component of a multi-faceted mitigative program to reduce sediment loadings from the hillsides. Other measures, which have already been implemented through Administrative Orders, include maintenance of existing terraces and construction of new terraces, gabions, and sediment detention basins. In addition, under the selected alternative (Alternative 3), large detention ponds will be constructed for flows in Bunker Creek (including those from Deadwood and Magnet Gulches) and Government Creek.

Constructed Wetland Treatment Systems Design Load

	Flow (cfs)	Metals (lbs/d)	Size (m^2)
Phase I			
Collected Water			
CIA Seeps	2.93	338	
Government Gulch	1.12	85.4	
sub totals	4.05	423.4	153,786
Ground Water	2.29	309	129,504
Phase II			
Collected Water			
CIA Seeps	2.93		
338			
Government Gulch	1.12	85.4	
Bunker Creek	3.41	23.2	
sub totals	7.46	446.6	299,478
Ground Water	2.29	309	129,504
PLAN TOTAL	9.75	755.6	428,982

If we use the mean monthly discharge values from 1985 to 1986 for Bunker Creek and Government Gulch as sample year-and-a-half flow data (from RI/FS Work Plan, 1987) we have the information listed on the following table. The amount exceeding design flow is listed separately for Bunker Creek and Government Gulch. It should be noted that in the future, the mine discharge, which is currently 1 cfs, could range up to 4 cfs.

Bunker Hill Site Surface Water Flows (1985-1986) compared to Design Flow of Collected Water Treatment System.

	Bunker Creek (cfs)	Amount beyond design flow of 3.41 cfs	Govt. Gulch (cfs)	Amount beyond design flow of 1.12 cfs	Combined Flows	Combined Untreated
1985						
Jan	4.4	0.99	1.4	0.28		
Feb	5.2	1.79	0.8	0		
Mar	11	7.59	3	1.88		
Apr	13.4	9.99	14	12.88		
May	5.2	1.79	6.4	5.28		
Jun	10.6	7.19	2.5	1.38		
Jul	3.8	0.39	0.2	0		
Aug	5.8	2.39	0.3	0		
Sep	5.4	1.99	0.4	0		
Oct	4.9	1.49	0.5	0		
Nov	12	8.59	3.2	2.08		
Dec	7.6	4.19	1.3	0.18		
1986						
Jan	9	5.59	2.4	1.28		
Feb	19.2	15.79	8.8	7.68		
Mar	15	11.59	5.8	4.68		
Apr	8.2	4.79	3.6	2.48		
May	7.8	4.39	3.4	2.28		
Jun	4.4	0.99	1.2	0.08		
Jul	3.8	0.39	0.8	0		
Sum	156.7	91.91	60	42.44	216.7 cfs	134.35 cfs
Flow not treated		58.6%		70.7%		62.0%

The percentage of the total flow of surface water that will be diverted around the treatment system is the sum of the amount exceeding design flow for each tributary divided by the sum of the flows. Thus 59 percent of the flow in Bunker Creek would be diverted around this treatment system during such an inflow period. Likewise 71 percent of the flow in Government

Gulch would also be diverted. The combined amount diverted would be 62 percent of the combined flows.

U.S. EPA RESPONSE # 68: The 1985-1986 flow data for Bunker and Government Creeks does not represent flows expected to enter the collected water wetland treatment system. For example, flows from the Central Treatment Plant, which comprise the bulk of flow in Bunker Creek, were much higher during this time frame than are anticipated under post-remediation conditions. Additionally, flows from both Bunker and Government Creek are expected to be lower under post-remediation conditions due to terracing and revegetation efforts, and, in the case of Government Creek, diversion of relatively clean flows from the upper water shed directly to the South Fork Coeur d'Alene River. Also, it should be pointed out that the "mean monthly flows" shown on Figure 8 in the Bunker Hill RI/FS Work Plan are based on weekly flow measurements (Bunker Creek) and daily flow measurements (5 days/week; Government Creek) (see the reporting requirements in NPDES Permit No. ID-000007-8). Therefore, the mean monthly discharge estimates are subject to a fair degree of uncertainty as they are not based on continuous flow recordings.

Comparing the Ecological Risk Assessment loadings across the site to the design flow loadings yields the following quantities of loadings beyond design flow.

Metal Load in SFCDR Beyond Design Load

	Low Flow (lbs/d)	High Flow (lbs/d)	Runoff (lbs/d)
Cd	4.5	22.1	33.2
Pb	8.2	501.5	332
Zn	738	2,607	2,937
Total Metals	750.7	3,130.6	3,302.2
Metals Beyond Design	0	2,375	2,546.6

U.S. EPA RESPONSE # 69: Based on Remedial Investigation data, contaminant concentrations are highest during low-flow conditions. Therefore, impacts to fish and other aquatic biota may be largest under these conditions which occur for the majority of a given year. An important functional parameter for the proposed subsurface flow wetlands is that they remain continuously saturated to maintain anaerobic conditions and preclude remobilization of precipitated metallic monosulfides. For this reason, the wetlands cannot be designed to accommodate both low and high flows without significant reduction in overall *effectiveness. Because aquatic toxicity concerns are greatest under low-flow conditions, the wetlands treatment system was designed to be fully functional under such conditions. This basic design also considers that concentration/aquatic toxicity is not a critical issue under high-flow conditions and that the source control/source containment measures included in Alternative 3 will significantly reduce contamination during high flows.*

It was not possible to assess the flow that would be directed to the ground water treatment cell. However, it is possible to speculate on overall removal efficiencies. Inflow from the ground water to the SFCDR in reach 5 is 6.1 cfs. For example, using the 45 percent capture rate assumed in the water quality technical memorandum combined with a 90 percent removal efficiency rate would lead to a (.45) (.90) (100) = 40.5 percent ground water metals removal rate in reach 5, assuming uniform ground water contamination. Considering that zinc ground water concentrations range from 35.7 to 47.7 mg/L a 40 percent removal rate would still leave zinc concentrations uncomfortably high. Ground water contributes approximately 30% of total onsite loadings during low flow (USEPA Region X 1991). Only 2.5 cfs (40.5% x 6.1 cfs) of the 16.9 cfs which flows from the ground water to the SFCDR would be treated with the ground water treatment system.

U.S. EPA RESPONSE # 70: The proposed ground water wetland is only a small component of a comprehensive plan to remediate the Site. This plan focuses on source containment and source control; thus, the ground water wetland is expected to provide a final step in the remediation train by removing residual contaminants from ground water entering the South Fork Coeur d'Alene River (SFCDR) to the extent practicable. Therefore, the commentor's use of pre-remediation concentration data to characterize loadings that will go untreated during high flow is inappropriate; such loadings will be greatly reduced by source-control efforts.

The commentor's evaluation of capture efficiencies of the ground water wetland is over-simplified. The assumption of "uniform ground water contamination" is not valid; use of this assumption ignores the intensive data collection efforts of the Remedial Investigation. For example, the referenced high zinc concentrations (35.7 to 47.7 mg/L) were noted in ground water samples from monitoring well GR-27, which is located near the center of the proposed ground water wetland. These concentrations typify those expected to enter the ground water wetland. Monitoring wells GR-26U and GR-25 are located along the SFCDR's gaining reach 5, west of the proposed ground water wetland. Zinc concentrations in samples from these wells are one and two orders of magnitude smaller than those in samples from GR-27 (GR-26U: 3.22 to 3.80 mg/L; GR-25: 0.070 to 0.149 mg/L). These concentration differences emphasize that proposed ground water wetland focuses on an area urgently requiring remediation.

Under the post-remediation scenario of Alternative 3, ground water flow to gaining reach 5 will be less than 6.1 cfs due to various remedial activities occurring upgradient (capture of flows in Government Gulch, cessation of seepage from the ponded area on the CIA east cell, etc.). Therefore, the ground water wetland is estimated to capture 2.29 cfs (0.45 x 5.09 cfs).

Details are provided in the Technical Memorandum: Post-Remediation Water Quality Projections for Feasibility Study Alternatives 2, 3, and 4. Also, the commentor is reminded that about 2.93 cfs of relatively contaminated ground water will be captured near gaining reach 3 (the "CIA seep" area) and treated in the collected water wetland.

Comparing the proposed wetlands treatment system to existing constructed wetlands treating acid mine drainage it is apparent that the bulk of experience for these systems is in the realm of free water surface systems.

U.S. EPA RESPONSE # 71: We agree that most available field data on wetland treatment systems are for free water wetlands. Comparison of:

- *annual treatment efficiencies for metals;*
- *seasonality of metal treatment efficiency;*
- *wetland hydrology; and,*
- *other important geochemical and biological aspects of wetland treatment systems.*

Between subsurface-flow, gravel-bed wetlands treating circumneutral drainage containing heavy metals and free water (surface-flow) wetlands treating highly acidic mine drainage containing primarily iron, manganese, and aluminum are not justified based on available information. Therefore, the Wetlands Technical Memorandum primarily considers experimental data on subsurface-flow wetlands in our proposed conceptual design.

Metal removal rates range from negative numbers (net increase) all the way up to 100 percent metals removals. The Big Five project is the primary source of information about subsurface flow systems to deal with metal mine drainage in this country.

U.S. EPA RESPONSE # 72: The Big Five project is one of a series of pilot projects in this country that have demonstrated the efficacy of the general technical approach of using subsurface-flow wetlands for metals removal in the absence of high acidity. At the time the Feasibility Study and Wetlands Technical Memorandum were written (late 1991), these were the available examples of studies on heavy metal retention in subsurface-flow wetlands. Recent research by others confirm earlier results. Thus, there is little scientific controversy over whether or not the biogeochemistry of subsurface-flow wetlands can be made to provide high retention efficiency of heavy metal cations via precipitation as monosulfides, adsorption onto biofilms, or retention by processes operating in these treatment systems where influent consists of near-neutral pH drainage of low iron content as is found at Smelterville Flats. The type of wetland treatment system used at the Big Five is obviously not the type of system

designed for Smelterville Flats. Although many of the important physical/chemical retention processes for metals will be the same, there are fundamental differences in hydraulic stability, residence time and other aspects in the proposed design for Smelterville Flats that address shortcomings in the design used at the Big Five.

Reported Big Five removal rates vary by author and which part of the system they choose to report on. The zinc retention efficiencies reported for the Morning Mine Rock-Filter Water Treatment System in Table 7 of the Technical Memorandum vary from 18 percent up to 75.7 percent.

U.S. EPA RESPONSE # 73: These data were presented only as an example of a local application of wetland treatment. With very little sophistication, this system has achieved removals of 18-76% dependent upon season. The point is that 76% of metals have been removed during some months in a totally passive, rudimentary system. This observation suggests that high retention efficiencies should be obtainable with a thoroughly designed system that provides management options as the seasons change.

The notion that the Big Five experience with cells of 19 m2 each is a good predictor for cells that would be 76,893 m2 each (19 acres * 4047 m2/acre) is questionable. The expanse of the proposed system may pose hydraulic challenges such as flow distribution, plugging, and short-circuiting.

U.S. EPA RESPONSE # 74: It is precisely because of the required hydrological loading of the constructed wetlands treatment system that design of modules and their subcells dictates the size indicated. Design work during remedial design on the required hydrology of the constructed wetlands modules will be done using computer simulation of probable through-flow to ensure that flow distribution, both vertically and horizontally, is acceptable and that plugging should not occur in an unacceptably-short time frame.

The evidence of efficient removal rates offered in Table 3 of the Technical Memorandum consists of four personal communications, three separate articles about the Big Five project, and one reference to a natural wetland.

Using concentration ranges from Table 4 of the Technical Memorandum we determined the following constituent loadings to the collected water system:

Loadings (lb moles/day) to Collected Water System

	Concentration Ranges
Zn	1.19 - 11.5
Cd	0.000995-0.132

Pb	0.000969 - 0.00484
Fe	2.21 - 8.02
Nitrate	0.675 - 2.72
Sulfate	39.1 - 557

The amount of sulfate required to form divalent sulfides for the high concentration range would be 2 * (11.5 + 0.132 + 0.00484 + 8.02) = 39.3 lb moles/day. The carbon required would be double the sulfate required, or 78.6 lb moles/day. Information on the organic carbon content is not readily available. Organic carbon levels are quite likely to be low and quite possibly to be limiting.

U.S. EPA RESPONSE # 75: Organic carbon is <u>not</u> expected to flow into the system in influent waters to an appreciable degree. Adequate seasonal availability of organic carbon to drive sulfate reduction is an issue and additional exogenous organic carbon sources will be available to the site manager if required. Based on total treatment system design, we can foresee no problem with organic carbon availability on an annual basis or during any particular season.

Iron should be precipitated in the upgradient pretreatment basins in the constructed wetlands treatment system and should not factor into organic carbon requirements.

If organic carbon was assumed to be 4 mg/L, the flow of 7.46 cfs into the collected water system would bring a loading of 13.38 lb moles carbon/day, far below the anticipated demand of 78.6 lb moles/day. Organic carbon may not even be as high as 4 mg/L.

Although the nitrate may interfere with sulfate reduction until it is used up, the amount of sulfate present is far greater than the nitrate, and nitrate does not appear to be plentiful enough to be limiting.

Operation and Maintenance

The operation and maintenance issues raise the following concerns:

Nutrient addition to the influent must be judiciously applied to maintain the proper levels of constituents and avoid interferences with the dissimulatory sulfate reduction. For example, the use of municipal wastewater for organic carbon (and to maintain base flow when required) may backfire if the wastewater nitrogen content is high enough to interrupt the sulfate reduction.

U.S. EPA RESPONSE # 76: Comment noted. The availability of better methods for achieving the organic carbon will be evaluated in the remedial design.

Cleaning the sedimentation basins annually to biannually may not be frequent enough to prevent excessive sediments from entering the wetlands treatment cells. Plugging of the wetland treatment cells could cause the subsurface flow system to become a free water surface system (Watson et al. 1989) and drastically alter the removal mechanisms and efficiencies.

U.S. EPA RESPONSE # 77: The overall conceptual design of the wetland treatment systems includes upgradient removal and retention features. Detention ponds and soil stabilization implemented on the hillsides will minimize sediment mass wasting downslope. Immediately above the constructed wetlands modules, pretreatment basins will be constructed to further remove sediment and iron precipitates. It is expected that only during the initial years of wetland treatment system operation will sediment load to the pretreatment basins be relatively high. In any event, the Operation & Maintenance Plan developed during the remedial design will require cleaning as necessary.

Monthly inspection of dikes, spillways, and conveyance facilities does not allow for immediate response to high flow events.

U.S. EPA RESPONSE # 78: It is acknowledged that routine monthly inspections of wetland physical facilities will not suffice for high flow events during early shakedown of the treatment facility. Inspection of the physical integrity of the wetland treatment system immediately after high flow events will be recommended until system stability to high flows is well established.

High flow events must be monitored to ascertain effectiveness of hydraulic design. Hydraulic retention time studies performed only twice a year are not frequent enough to adequately detect plugging and flow problems.

Bioaccumulation studies performed once a year likewise are not frequent enough to respond to any problems of bioaccumulation.

U.S. EPA RESPONSE # 79: Monitoring is included in the ROD. The details of the monitoring requirement will be determined during the remedial design.

Eventual disposal of wetlands precipitates is not adequately addressed.

U.S. EPA RESPONSE # 80: Long-term management of wetland substrate and operations and management considerations will be an integral part of the remedial design.

If they are to be left in place in the flood plain of the SFCDR it must be proven that they will remain in their precipitated form. The introduction of oxygen via fluctuating water levels will cause sulfide oxidation and release of the previously sulfide-bound metals. Accordingly, maintenance of wetland water levels under all weather and flow conditions is crucial for metal removal dependent on sulfide precipitation (Hedin, Hammack, and Hyman 1989).

Temperature may be much more problematic than anticipated. Measured rates of sulfate reduction in lake sediments and natural wetland substrates have been very low in winter months (Hedin, Hammack, and Hyman 1989). In a free water surface wetland reported by Stark et al. (1988), the amount of Fe removed fell to as low as 35 percent in the winter, and rose to a high of 75 percent in the summer. Subsurface system results for the Morning Mine reported on Table 7 of the Technical Memorandum reveal that the three lowest months of removal for the year were January, October, and November, with removal rates of 36.8, 18.0, and 39.7 percent, respectively. As these results are for a subsurface flow system which is also in Idaho in the upper SFCDR basin area, they do not bode well for temperature independence of this system.

U.S. EPA RESPONSE # 81: The constructed wetland treatment systems are designed to remain saturated under low-flow conditions; this is why shunting of seasonal high flows is necessary. Low metals retention observed during winter at the Morning Mine system are not applicable to the constructed wetlands proposed for Smelterville Flats because of their entirely different design features. Thermal modeling will be part of the remedial design.

Conclusions

Questions of scale, untreated loadings, and removal efficiencies plague this plan. Operation and maintenance issues are not adequately addressed. Loadings missed due to lack of capture of all but low flow are the biggest problem with this plan. Loading assessment reveals that over half of the flow from Government Gulch and Bunker Creek will bypass the wetland cells entirely. As high flow conditions contribute greatly to the loadings in the SFCDR, much of the contaminant loadings to the SFCDR will not be treated to begin with. The loadings beyond design load for high flow and run off conditions are at least 2,000 lbs/day of combined metals. Combined metal loadings to the South Fork of the Coeur d'Alene River from the site may not even be cut in half by implementation of this plan.

The next biggest problem has to do with scale. A system of this size is far beyond any experience in any type of constructed wetlands as reported in the literature. Laboratory column studies and 19 m2 cells are a far cry from 19 acre cells (76,893 m2) that are proposed. The 106 acre total (428,982 m2) is far beyond the experience reported in the literature (87,500 m2 the largest in our literature review).

U.S. EPA RESPONSE # 82: It must be recognized that the efficacy of the general hydrologic and biogeochemical approach of using subsurface-flow, gravel-bed wetlands, having a diversity of retention mechanisms available to remediate heavy metals from near-neutral pH mine drainage, is well established. It is not an experimental idea but has been consistently demonstrated in the laboratory and in the field. A full-scale field module demonstration and

tuning program is necessary to develop operational parameters for the constructed wetland treatment system. This is what has been proposed at the Site.

Removal efficiencies are a much greater unknown than is acknowledged by the Technical Memorandum. Temperature, carbon content, loadings, and hydraulics all impact removal efficiencies. The temperature, carbon content and loading effects are probably best explored in a small scale pilot plant. Organic carbon may be limiting in this sulfate reduction system. The removal rates may prove to be much lower than anticipated, and chemical treatment may be required to meet discharge limits.

U.S. EPA RESPONSE # 83: As indicated in the Wetlands Technical Memorandum, removal efficiencies of constructed wetland treatment systems at Smelterville Flats are not fully predictable. However, high retention efficiency (90% or greater) on an annual basis is expected based upon existing information and experience. The lack of full predictability, especially over all seasons, has been acknowledged in the ongoing design effort for the first constructed wetlands module. Accordingly, the constructed wetlands module is conceived as a wetlands treatment system with operational components made available to the site manager for control of system hydrology and to augment important chemical conditions during any season as required by observed operational efficiencies. Thus, the wetlands treatment system is viewed as an active system in the sense that some monitoring and adjustment of operational parameters may be necessary during the early learning phase of system operation. Exactly how much operation and maintenance activity will be required for the fully functional and mature constructed wetlands system presently is unknown.

APPENDIX E

COMMENTS FROM THE POTENTIALLY RESPONSIBLE PARTIES

July 23, 1992

Mr. Nick Ceto
Project Coordinator
U.S. EPA - Region 10
1200 Sixth Avenue
Seattle, Washington 98101

RE: Review of the Proposed Plan for the Bunker Hill Superfund Site

Dear Mr. Ceto:

The Bunker Hill Cooperating PRPs (Asarco Incorporated, Sunshine Mining Company, Sunshine Precious Metals Company, Callahan Mining Company, Coeur d'Alene Mines Corporation, Union Pacific Railroad, Hecla Mining Company, Gulf USA Corporation/Pintlar Corporation, and Stauffer Management Company) have reviewed EPA's June 12, 1992 Proposed Plan for remediation and offer the following comments to be included as part of the administrative record. The PRPs generally agree with the Proposed Plan's evaluation of the alternatives presented in the Bunker Hill Superfund Site Feasibility Study (MFG, 1992). Consistent with the Feasibility Study, the Proposed Plan notes the acceptability of Alternative 2 as a protective remedy for the site. The PRPs also believe that Alternative 2 provides adequate levels of remediation. However, considering the nature of the site and the contrast in benefits between Alternatives 2 and 3, the PRPs support EPA's selection of Alternative 3 as the preferred alternative.

However, in our view, several broad issues and a number of specific technical aspects of the Proposed Plan require comment and/or clarification. We have divided our comments and requests for clarification into two groups. The first portion of this letter addresses general concerns associated with the Introduction and Sections I through V of the Proposed Plan. The second portion reviews the specific technical aspects of the preferred alternative subarea descriptions provided in Section VI and Table 3: Summary of Site Wide Remedial Action Alternatives by Subarea.

GENERAL COMMENTS

- Within the introduction section EPA states that, with reference to EPA's remedy another response action based upon information found in the Remedial Investigation/Feasibility Study (RI/FS) and public comment." We believe EPA appreciates that each of the alternatives developed and presented in the FS for this site are comprehensive alternatives comprising a series of integrated, interdependent components designed to work as a whole. Substitution of alternative components jeopardizes the effectiveness of the alternative. We therefore support the selection of Alternative 3, unmodified and in its entirety, as described in the FS Report.

U.S. EPA RESPONSE # 1: The selected remedy represents a comprehensive and effective alternative for site cleanup. Although some modifications and clarifications were made to the preferred alternative, the effectiveness of the alternative has been enhanced rather than jeopardized.

- The importance of a community-supported Institutional Controls (IC) Program as part of all considered alternatives is first discussed in Section III of the Proposed Plan. The PRPs agree that Institutional Controls are a necessary component of the preferred alternative, but also note the community's concern that such controls not be unduly burdensome or intrusive. The PRPs anticipate working cooperatively with local governments to develop a specific program that will promote voluntary compliance. We note also that several of the PRPs are currently major land holders in the community, and as such will participate in the continued development of the Silver Valley.

  An effective package of Institutional Controls is an essential component of Alternative 3. The ICs will supplement the technical and engineering elements in the remedy, thereby making the remedy more effective and most cost-effective. The IC program will provide backup to engineering measures by layering remedial measures to assure permanence of the remedy.

  Remedial planning efforts at the site until now have focused on removal and source control actions. Continued progress with ICs will require a broader, more comprehensive effort than has previously taken place. Although the Proposed Plan outlines areas in which ICs will be needed, it of necessity does not specify the entity that will administer ICs, and the implementability and effectiveness of ICs. As the specifics of the IC program are developed, the following issues should be considered:

  - Many of the most useful ICs derive from measures employed routinely to serve purposes other than Superfund remedies. Examples include public land use controls such as development permitting or floodplain regulations, and private property restrictions and use easements. The Proposed Plan does not address privately held land rights and their use as ICs. Such rights can be significant, given the extensive PRP ownership of land within the site.

U.S. EPA RESPONSE # 2: Comment noted and such measures will be considered during further development of the Institutional Controls Program (ICP).

- There is no identified relationship in the Proposed Plan between the risks assessed (and evolving results over time) and the controls suggested. The ICs in the Proposed Plan instead appear to target a static factual setting. The ROD should acknowledge that specific ICs must be developed which recognize that the use of land has a role in determining future risks and in defining what criteria are appropriate.

U.S. EPA RESPONSE # 3: The ICP as developed to date envisions using barriers appropriate to the planned land use (See Tables 4.2, 4.3, and 4.4 in "An Evaluation of Institutional Controls for the Populated Areas of the Bunker Hill Superfund Site"). Therefore, this comment is already incorporated into the ICP.

- The involvement of local governments apart from the Panhandle Health District must be addressed. As stated above, existing local regulations together with the Environmental Health Code could form a strong package to support Alternative 3. Local regulations and authority must be matched with local capacity to apply the regulations. Growth and changed land use in the area must be anticipated by the ICs.

U.S. EPA RESPONSE # 4: Comment noted and will be considered during further ICP development.

- The Proposed Plan does not address the use of ICs to manage public water supplies. The ROD should describe the effectiveness of ICs in this regard and in particular should note the necessity for a prohibition of wells in certain areas for the foreseeable future.

U.S. EPA RESPONSE # 5: The Idaho Department of Water Resources is in the process of defining an "Area of Drilling Concern" within the Site that would require specific drilling and well closure practices to prevent cross-contamination from contaminated to clean water. The purpose would be to protect the water resource. Appropriate uses of well water would be addressed in the educational portion of the ICP.

- Physical barriers and their protection have been considered in planning efforts thus far. However, more work needs to be done to address the connection between barrier requirements and where and how development takes place. The scope of managing such a program needs to be considered as well.

U.S. EPA RESPONSE # 6: Comment noted and will be considered during further development of the ICP.

- Given that the nature of the ICs and the management system for them are only generally outlined, the cost estimates in the Proposed Plan can be considered to be useful only for comparison purposes. The ROD should note that costs for the final program could vary considerably.

U.S. EPA RESPONSE # 7: The ROD recognizes that cost estimates for various components of the selected alternative may vary significantly. However, the overall cost estimate is consistent with RI/FS Guidance (U.S. EPA 1988).

- Also within Section III, the relationship of Applicable or Relevant and Appropriate Requirements (ARARs) to Remedial Action Objectives (RAOs) is discussed. We concur with EPA's assessment that the RAOs have been designed to consider pertinent risk management criteria and ARARs, and that attainment of RAOs will provide an acceptable level of protectiveness. Additionally, we agree that reliance on performance standards for individual remedial actions can provide a realistic measure of success for specific actions.

However, there are certain ARARs, as identified in the FS Report, which cannot be attained by remedial action. For example, these include attainment of the Maximum Contaminant Level (MCL) for cadmium throughout the upper zone of the site ground water system and the Federal Water Quality Criteria (FWQC) for cadmium, lead, and zinc in the SFCDR throughout the site. We believe that technical impracticability waivers are compelled for these contaminants and areas of the site. Within Section V of the Proposed Plan: Analysis of Alternatives, the issue of a waiver for these areas is first discussed and under the summary analysis for each alternative, EPA states that ARARs waivers will be considered "only after review of the effectiveness of remedial actions in meeting their respective performance standards." In Section 8.2.2 of the FS, however, the analysis demonstrates that even with total elimination of all accessible onsite sources, the previously-discussed water quality ARARs would not be obtained. This analysis clearly provides a factual basis for a technical impracticability waiver.

Remedial actions selected in the Record of Decision (ROD) must attain those ARARs that are identified at the time of the ROD signature or provide grounds for invoking a waiver (30 CFR §300.430 (f)(1)(ii)(B)). EPA regulations and guidance state that when an alternative is chosen that does not attain an ARAR, the justification for waiving the requirement must be fully documented and explained in the ROD (40 CFR §300.430 (f)(5)(ii)(C); OSWER Directive 9234.2-03FS). Based on its own regulations, then, EPA is obliged to make appropriate evaluation of whether a selected remedy will attain ARARs before implementation, or provide grounds for invoking a waiver. In United States v. Akzo Coatings of America, 949 F.2d 1409

(6th Cir. 1991), involving CERCLA remedy selection challenge, the Court held that CERCLA and its own regulations compel EPA to determine before implementation whether a remedy will meet designated ARARs for a particular site or waive compliance with the ARAR.

A remedial action that does not meet an ARAR under federal environmental or state environmental or facility siting laws may be selected under the following circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate federal or state requirement;

- Compliance with the requirements will result in greater risk to human health and the environment than other alternatives;

- Compliance with the requirement is technically impracticable from an engineering perspective;

- The alternative will attain a standard of performance that is equivalent to that required under the alternative applicable standard, requirement or limitation through use of another method or approach;

- With respect to a state requirement, the state has not consistently applied or demonstrated the intention to consistently apply the promulgated requirement in similar circumstances or other remedial actions within the state; or,

- For Fund-financed response actions only, an alternative that attains the ARAR will not provide a balance between the need for protection of human health and the environment at the site and the availability of Fund monies to respond to other sites that may present a threat to human health and the environment (42 USC §9621 (d)(4); 40 CFR §300.430 (f)(1)(ii)(C)).

None of the grounds for invoking waivers allows EPA to consider waivers when "remedial actions that meet performance standards are successfully implemented", as EPA proposes for the Bunker Hill Site. The "waiver of compliance with an ARAR would not mean much if it could only be invoked at the completion of the remedy." United States v. Akzo Coatings at 1447.

Of the grounds for waivers outlined above, we note that EPA has frequently applied technical impracticability waivers in situations similar to the Bunker Hill Site. EPA guidance prescribes the technical impracticability waiver for situations where: 1) engineering methods necessary to construct and maintain an alternative that will meet ARAR cannot reasonably be implemented; or 2) potential for the alternative to continue to be protective into the future is low, either because continued reliability of technical or institutional controls is doubtful or because of inordinate maintenance costs (OSWER Dir. 9234.2-03/FS). For example, if MCLs cannot be attained because of complex hydrogeology due to fractured bedrock, the technical impracticability waiver should be used (OSWER Dir. 9234.2-06/FS). At two sites, EPA has waived ARARs on the basis of technical impracticability because water quality had already been degraded above MCLs by contamination from other sources (see e.g., Caldwell Trucking, New Jersey; Whitewood Creek, Montana).

We recognize that, when addressing a remedial technology that may or may not be technically impracticable, EPA has, on occasion, employed a "contingent" ARAR waiver. It is clear from CERCLA and the NCP that if an ARAR is waived, the waiver must be documented and justified in the ROD. EPA guidance, nonetheless, allows EPA to identify in the ROD an ARAR waiver based upon technical impracticability that is triggered only if certain conditions occur in the future (OSWER Dir. 9234-2-10/PS-A).

"When sufficient information is available at the time of ROD signature indicating the possibility that an ARAR waiver may be invoked at the site (e.g., the RI/FS indicates that it may be technically impracticable to attain non-zero MCLGs or MCLs in the ground water based upon final determination of the size and scope of the contaminated plume), the lead agency may consider including a contingent waiver in the ROD. RODs with contingent waivers should provide a detailed and objective level or situation at which the waiver should be triggered. In addition, the ROD should specify that the contingency is reserved to be decided at a later date, so that if the contingency is invoked, the resulting documentation is part of the administrative record. (OSWER Directive 9234-2-10/PS-A; emphasis added.)

This guidance is seemingly intended to allow EPA to design a remedy to achieve ARARs, some or all of which may be subsequently waived if it becomes obvious later that they are technically impracticable to attain. Under this approach, the ARAR waiver must be documented and justified in the ROD on the basis of technical impracticability, but will not be triggered until the remedial technology, in fact, is proven to be technically impracticable. (We note that EPA has identified a contingent ARAR waiver at the Silver Bow Creek, Montana Site). Nevertheless, EPA cannot invoke a contingent waiver unless it is uncertain whether the selected remedy practicably can attain ARARs. No such uncertainty exists at the Bunker Hill Site. While the PRPs recognize EPA's efforts to provide flexibility in the Proposed Plan for this complex site, there are other options such as contingent waivers which provide such flexibility but are consistent with the NCP.

U.S. EPA RESPONSE # 8: The remedy selected by the ROD is anticipated to meet surface water ARARs within the remediated areas. The remedy selected by the ROD also strives to meet ARARs for the ground water within the remediated area.

Based on information obtained during the Remedial Investigation, and the analysis of remedial alternatives, U.S. EPA and the State of Idaho believe that the selected remedy may be able to achieve the water quality improvement objectives stated above. However, ultimate attainment of federal Drinking Water Standards (DWS) in the valley aquifer system will in part depend upon the success of upstream water quality improvement initiatives in controlling contaminant loading to the valley aquifer system, as well as onsite actions. Ground water contamination *may be especially persistent in the immediate vicinity of contaminant sources, and in portions of the valley aquifer system most strongly influenced by upgradient surface and ground water contamination.*

The ability to achieve cleanup goals (DWS ARARs and protection of surface water quality) at all points throughout the valley aquifer system cannot be determined until the remedial actions outlined in this ROD have been effective in meeting their individual performance standards (specified in Chapter 9 of the ROD), and upgradient efforts to improve water quality have been implemented. If the selected remedy cannot meet DWS throughout the valley aquifer system, notwithstanding upgradient efforts that may be implemented independently of the CERCLA action to improve ground water quality entering the Site, the contingency measures described in this section may replace the selected remedy and ground water cleanup goals. These contingency measures will include refinement of ground water recovery and treatment system components of the remedial action, and continuation of institutional controls.

If it is determined, based on the successful implementation of the selected remedy, and contingency measures, that certain areas of the valley aquifer system cannot be expected to meet ARARs, notwithstanding whatever additional efforts which may be made, independently of this CERCLA action, to improve upgradient ground water quality entering the Site, then a chemical specific ARAR will be waived for the cleanup of those portions of the valley aquifer system not meeting ARARs.

- We also suggest that the ROD clearly identify an estimate of past costs and future populated area costs, beyond the figure provided in Table 4 of the Proposed Plan. Past costs to date total roughly $19 million and per EPA/IDHW's ROD for Residential Soils, an additional $40.8 million is estimated for yard remediation. This increases the cost of each alternative by approximately $60 million. The public should have an accurate perception of total cleanup costs for the site.

U.S. EPA RESPONSE # 9: The total cost of site wide cleanup has been included in Table 8-2 of the ROD.

Comments related to the Proposed Plan's description of the preferred alternative are provided below, by subarea. As stated previously, the Cooperating PRPs support the selection of Alternative 3 as the preferred remedy. Many of the comments below provide clarification as to specific aspects of a subarea component. In most instances, the clarification is provided to resolve possible discrepancies between the FS and the Proposed Plan. It is thought that these discrepancies are primarily due to the summary level of detail provided in the Proposed Plan. It is anticipated that these details will be worked out as part of the remedial design process.

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Central Impoundment Area (CIA)

- The CIA description is generally consistent with the FS; however, when discussing the fate of process materials relocated to the Lead Smelter from the CIA, the description appears to imply treatment for all materials which are not reprocessed or recycled. Absent justification in the record, this statement should be clarified to note that, consistent with the RI/FS, only remaining Principal Threat Materials will be treated by cement based stabilization/fixation. Per the RI/FS, relocated wastes which are not recycled or reprocessed and are not Principal Threat Materials will be disposed under the Lead Smelter Cap without treatment.

U.S. EPA RESPONSE # 13: The process for making treatment decisions has been clarified in the ROD (see Figure 9-1) to show that non-Principal Threat materials will be disposed under the Lead Smelter Cap without treatment.

Page Pond

- The Page Pond subarea discussion may be interpreted to mean that all tailings accumulations will be removed from the West Swamp. The FS and draft Work Plan describe that accessible tailings in the vicinity of the West Beach will be removed down to an approximate elevation of 2,186.7 feet. The Plan calls for construction of an outlet weir to maintain the water level in the West Swamp at a minimum elevation of 2,189 feet, thus causing all remaining tailings to be continually submerged, and therefore, not susceptible to drying, oxidation, and subsequent transport. Preliminary engineering estimates indicate that in total 40 to 60 thousand cubic yards of tailings will be relocated to the Page Tailings Impoundment by these efforts.

U.S. EPA RESPONSE # 14: The ROD indicates that 40-60 thousand cubic yards of jig tailings accumulations will be removed. The final amount of material removal will be dependent on vegetated status, surficial soil contaminant concentrations, water levels, and habitat status. Appropriate federal and state natural resource management agencies will work with U.S. EPA and IDHW to determine appropriate management and operations of the area that could be submerged.

- The Proposed Plan discussion indicates that flows from Humboldt and Grouse Creeks will be diverted around the Page Pond area to "minimize the contamination of these surface streams from Page Pond tailings...". However, the RI/FS analysis envisions that these flows will be directed into and through the Page Swamp system in order to sustain desired minimum water levels in the swamps and the continued submergence of tailings remaining in those areas. This action would involve channel improvements, but not lining the channels. The Proposed Plan discussion implies that the channel would be lined, for which justification is not evident.

U.S. EPA RESPONSE # 15: The ROD states that contact with tailings and Humboldt and Grouse Creek waters will be minimized by use of diversions and channel modifications. The final determination will be based on the decisions relating to appropriate management and operations of the area that could be submerged (see U.S. EPA RESPONSE 14). It is important to note that if it is found that a wetlands at Page Ponds would not adequately protect wildlife and migratory birds, an alternative remedial action to the one identified in the comment would need to be implemented to protect surface water quality.

- Although habitat improvement will result as a result of the remediation, it is not clear what is meant in the statement that "habitat considerations" will be considered during the remedial design. Appropriate statutory provisions regarding habitat issues will be considered during design.

U.S. EPA RESPONSE # 16: The appropriate habitat considerations will be made by U.S. EPA and IDHW after evaluation of vegetative status, surficial soil contaminant concentrations, water levels, and habitat status and consultation with the appropriate state and federal natural resource agencies.

Smelter Complex and Mine Operations Area (MOA)

- The description for this subarea is generally consistent with the FS and provides a sound approach for consolidation and isolation of contaminated materials while minimizing the amount of land dedicated to long-term containment. This aspect of Alternative 3 also emphasizes recycling and reprocessing of residual materials to further minimize the volume of material to be consolidated under the Lead Smelter cap. In addition, the treatment of remaining Principal Threat Materials minimizes the potential for future exposure.

U.S. EPA RESPONSE # 17: Comment noted.

- Within the Proposed Plan, the A-4 Gypsum Pond is identified as either being capped or relocated to the CIA. A plan for drainage improvement and capping of the A-4 Gypsum Pond is currently under development. Preliminary engineering studies indicate that effective capping can be accomplished. In our view, relocation of the A-4 Gypsum Pond is not considered to provide a meaningful contribution to contaminant loading reductions relative to in-place closure.

U.S. EPA RESPONSE # 18: The final determination regarding the A-4 Gypsum Pond will be based upon the engineering feasibility of closing the pond in-place and additional consideration for ground and surface water hydrology in that area. The comment is noted.

Constructed Wetlands Treatment Systems

- The Constructed Wetland Treatment System discussion of the preferred alternative indicates that "the constructed wetland treatment system will treat a minimum of 8 cubic feet per second of contaminated water". It is assumed that this statement is referring to the collected water wetland treatment system and is somewhat ambiguous as both the collected water and ground water systems are constructed wetlands. The collected water wetland system will be designed to treat a maximum flow of 7.46 cubic feet per second, as noted in the Technical Memorandum: Constructed Wetland Treatment Systems for Remediation of Metals in Site Drainage. Projected flows for the ground water system are on the order of 2 to 3 cfs.

U.S. EPA RESPONSE # 19: The comment has been noted and the difference between the two systems has been clarified in the ROD.

Rights-of-Way (ROW)

- The list of remedies provided in the Proposed Plan are consistent with the FS. However, at EPA's direction, ROW were divided into two categories within the FS: Populated Areas and Non-Populated Areas. Remedies for these two categories are not necessarily consistent because of large differences in exposure potential. The Proposed Plan states that "in all cases, ROW contributing to contaminant migration (i.e., > 1,000 ppm lead) via air or water will be addressed through an appropriate cap or removal action." This statement requires clarification as it does not correlate with the division of the ROW into Populated and Non-Populated Areas and prior Proposed Plan statements which call for site specific determinations based on location, utilization, and contaminant concentrations.

U.S. EPA RESPONSE # 20: All site ROWs are addressed under the same heading because they will be managed to minimize contaminant migration and direct contact. The ROD clearly states that the ROW remedial actions will be site specific based upon location, utilization and contaminant concentrations.

Commercial Buildings and Lots

- Commercial buildings and lots may pose risks similar to those in residential settings, however, the extent of such risks is dependent upon the type of commercial building and lot. Schools, churches, and empty lots within the residential areas have the highest potential for similar risks; other areas, such as office buildings or industrial sites would not pose similar risks. It should be noted that school yards and playgrounds were remediated during previous removal actions. Requirements for remediation of commercial buildings and lots should be based on current uses. Correspondingly, the residential soils ROD requirements should only be applicable where exposure scenarios are similar to those for residential yards.

U.S. EPA RESPONSE # 21: Comment noted. The ROD addresses these concerns in Section 9.2.7.

- The barrier requirements cited in the Proposed Plan are not consistent with current actions within the residential areas. Barriers less than 12 inches in thickness have been used at locations where contamination does not exist at depth. These criteria should apply to commercial buildings and lots rather than the mandatory 12-inch criterion cited in the Proposed Plan.

U.S. EPA RESPONSE # 22: The Residential Soil ROD identifies two remedial actions. One is placement of a 12 inch clean soil barrier. The second is a complete removal of contaminants up to a depth of 12 inches. Therefore, anytime contaminants are left behind at a commercial property utilized by a sensitive population, a 12 inch barrier is mandatory. In the cases where contamination at depth does not exist, a complete removal has been accomplished rather than a barrier installed. A complete inventory of commercial properties and their current uses and extent of remediation will need to be compiled and evaluated during remedial design.

- The Cooperating PRPs support the encouragement of interior cleaning by occupants. Such self-enforcing actions by the community have contributed to the goal of reducing site wide blood lead levels and have the highest chance of continued widespread community acceptance.

U.S. EPA RESPONSE # 23: Comment noted.

Residential Interiors

- The Cooperating PRPs support the continuation of existing Panhandle Health District educational and health intervention programs. The continued education of residents about procedures to be followed for normal replacement of carpets, insulation, and other remodeling activities is also supported.

U.S. EPA RESPONSE # 24: Comment noted.

- Current site data show that residential soils and interior dust lead concentrations are dropping in unison with child blood lead levels, however, no direct correlation between residential interior dust concentrations and child blood levels is exhibited. Any consideration of the remediation of residential interiors must be linked to the primary site RAO of preventing the redistribution of lead from onsite sources so that 95 percent or more of children (ages 0 to 10) have blood lead levels less that 10 μg/dl and less than

1 percent have blood lead levels greater than 15 $\mu g/dl$, and not based solely on house dust concentrations. Any requirement for cleaning of residential interiors must first be linked to evidence that residential interiors concentrations are responsible for elevated blood lead levels. The sources of interior lead must also be linked to PRP activities before remedial actions by these PRPs can be imposed. In any event, it must be demonstrated that a one-time cleaning to remove contaminants, present due to PRP activities, would be a cost-effective method for remediation. Experience to date at the site indicates that health intervention program and routine cleaning by residents are the most effective measures for reducing blood lead levels.

U.S. EPA RESPONSE # 25: ***The impacts of interior house dust contaminated with lead on children have been evaluated in the Site risk assessments. The 1000 ppm cleanup level with a community average of 500 ppm for residential interiors represents a health based evaluation of house dust risks. Therefore, the cleanup level is based on predicted health impacts.***

- The Proposed Plan indicates that the criteria for residential interior cleaning will be a site wide average of 500 ppm lead with actions for individual homes with concentrations greater than 1,000 ppm. Consistent with previously submitted comments on the Populated Areas Human Health Risk Assessment and the Residential Soils ROD, the Cooperating PRPs do not agree with these criteria and point out that the site specific risk analyses support a higher number than 1,000 ppm lead for both residential soils and interior dust concentrations. Further, the basis for the criteria was not a partitioning or speciation of the sources of lead, recognizing the known differences in availability and bioavailability of these sources.

U.S. EPA RESPONSE # 26: See U.S. EPA RESPONSE 25 above.

<u>Future Development in Non-Populated Areas</u>

- The Cooperating PRPs agree with the exclusion of areas dedicated to the remediation, such as Lead Smelter cap and wetlands, from the developable lands category.

U.S. EPA RESPONSE # 27: Comment noted.

- The Proposed Plan states that in areas where lead concentrations are below 1,000 ppm no special considerations will be required beyond those typically required for new developments. This statement is in agreement with our understanding of requirements for new residential developments. The Proposed Plan then identifies future development in undeveloped areas as an exception to the approach described above, and imposes an average yard concentration requirement of 350 ppm. This is not consistent with the Plan's previous statement that no special requirements will exist in areas with less than

1,000 ppm lead. These contrasting statements require clarification. As indicated above, we believe this criterion is very conservative.

U.S. EPA RESPONSE # 28: This discussion has been clarified in the ROD. It is important to note that the cleanup levels adopted in the Residential Soils ROD carried two criteria. First, a "threshold" criterion required that no yard should have residential soil concentrations equal to or above 1000 ppm. Secondly, the community wide average needed to be approximately 350 ppm lead or below. The requirement of a new development to have an average soil lead level of 350 ppm was in recognition that children play in various areas throughout a neighborhood and are exposed to soil from neighbor's yards as well as their own. A 1000 ppm "threshold" cleanup level is appropriate only when the neighborhood or community average is 350 ppm or below.

- The Proposed Plan should indicate that sampling for surface concentrations relative to a certain criterion will occur after construction activities are complete and that conventional construction techniques such as grading and/or deep tilling may be used to reduce surface concentrations.

U.S. EPA RESPONSE # 29: The comment has been noted and will be fully considered in the development of the ICP which will govern future development remedial requirements.

- It is not clear what is meant by "the development would need to be effectively isolated from nearby areas that would expose residents to surficial lead concentrations exceeding 1,000 ppm". The site wide cleanup prescribed by Alternative 3, coupled with ongoing Institutional Controls for risk management, effectively address such issues. However, surface concentrations in excess of 1,000 ppm will exist for certain areas of the site and, according to the risk assessment, such areas may be acceptable for certain forms of recreation. Furthermore, imposing such an isolation requirement on developers may not be a step that local governments have the legal authority to take.

U.S. EPA RESPONSE # 30: The comment has been noted and will be fully considered in the development of the ICP which will govern future development remedial requirements. The purpose of the isolation is to ensure that primary recreational activities occur in the residential area where the community mean is 350 ppm or lower.

- The Cooperating PRPs also reiterate that among them they currently hold a majority of the developable land within the 21-square mile site. These PRPs anticipate using deed restrictions/notices to assure that future development in these areas complies with the community Institutional Controls Program.

U.S. EPA RESPONSE # 31: The comment has been noted and will be fully considered in the development of the ICP which will govern future development requirements.

Public Water Supply Considerations

- The Cooperating PRPs are currently working with the communities to develop a suitable source of offsite water. However, it is not the responsibility of the PRPs to upgrade existing systems to conform with EPA Safe Drinking Water Act requirements for surface water sources.

U.S. EPA RESPONSE # 32: Ground water within the Site currently exceeds drinking water standards. Thus, a safe water supply must be available to the community. This may require additional response actions in the future. See Section 9.2.11 of the ROD.

Soil Action Levels

- The Cooperating PRPs support the action-specific approval outlined for the preferred alternative as the most appropriate for such a large and varied site. Its use also will minimize the impact on future development. The use of numerical soil cleanup criteria is not feasible and would result in an impractical and inefficient remediation program.

U.S. EPA RESPONSE # 33: Comment noted.

Review of Table 3

- The following inconsistencies were noted in Table 3:
    - Under the Mine Operations Area, the last item "Treat Mine Water if discharging in an ungraded CTP or new conventional Treatment Plant" is not required.
    - Under the Mine Operations Area, decontamination of buildings should be included under Alternative 3.
    - Under Page Pond, it should be noted that both the East and West Swamp wetlands will both be enhanced under the preferred alternative.

U.S. EPA RESPONSE # 34: Comment noted.

Please contact us if you have any questions related to these comments.

Sincerely,
McCULLEY, FRICK & GILMAN, INC.

Steven A. Werner
Project Manager

Submitted by
McCulley, Frick & Gilman, Inc.
on behalf of the following PRPs:

Asarco Incorporated
Callahan Mining Co.
Coeur d'Alene Mines Corp.
Hecla Mining Co.
Stauffer Management Co.
Sunshine Mining Co.
Sunshine Precious Metals Co.
Union Pacific Railroad
Gulf USA Corporation/
Pintlar Corp.

SAW:mg
EPA-PP1.LTR
cc: Distribution

A representative of Sunshine Mining Company also submitted a comment letter dated August 4, 1992. This letter raises concerns about the possible differences in biological availability of lead oxides and lead sulfates, and recommends that U.S. EPA establish an official distinction between lead sulfide and lead oxide. The commentor is further concerned about the impact the 1000 ppm lead action level set for residential soils will have on the remainder of the project.

U.S. EPA RESPONSE: The soil remediation threshold level of 1000 ppm Pb was established in the Residential Soils Record of Decision issued by U.S. EPA in August 1991. U.S. EPA utilized a considerable body of site specific data to apply the Uptake Biokinetic (UBK) Model for Pb to the specific circumstances at the Bunker Hill Site. It is U.S. EPA's position that the successful application of the UBK model to site specific data at the Bunker Hill Site reflects an appropriate consideration of all model inputs, including bioavailability of the various physical and chemical forms of lead at the Site.